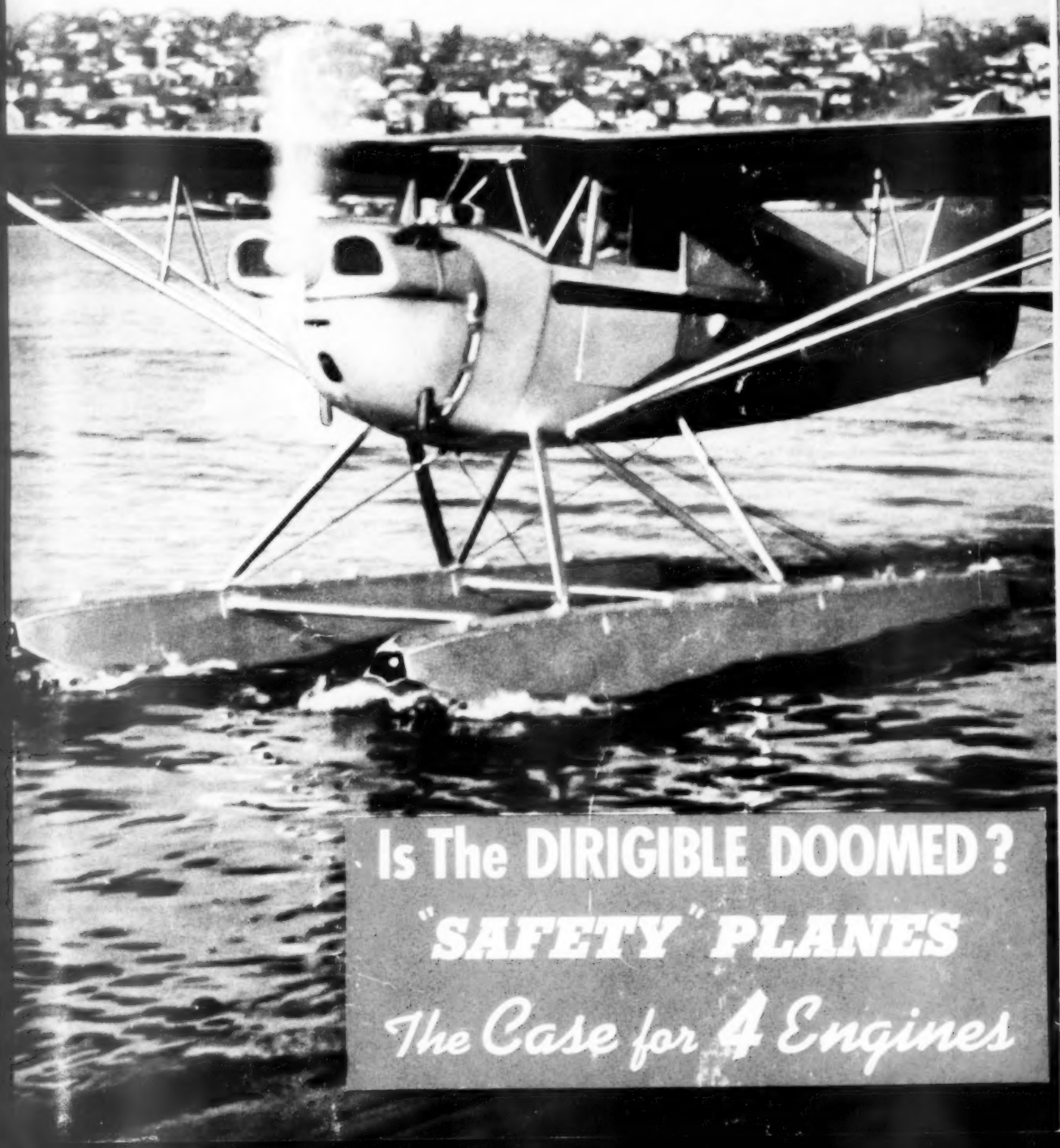
Anti-Aircraft Failed in Spain

POPULAR AVIATION

JULY
25c



Is The DIRIGIBLE DOOMED?

"SAFETY" PLANES

The Case for 4 Engines

FOR THOSE WHO APPRECIATE

Fine Things

THE STINSON 'RELIANT' ★ THE STINSON "105"

The 'Reliant's' new cowling is sleeker. Stainless steel louvers, name plate, streamlined exhausts with chevron design and attractive striping add style and dash.

The Stinson "105" costs only *$2995.00 at Wayne, Michigan. Only $998.00 d... on finance plan. Note decorative stainless steel treatment on grilles and exha...

*Including Federal taxes, not including state or local taxes.

Additional streamlining and retractable entrance steps increase the 'Reliant's' speed. Flaps and hydraulic brakes enable the 'Reliant' to land with a roll of only 250 feet.

The "105" is a roomy plane with racy lines; excellent vision on ground and aloft. Flaps, wing slots and hydraulic brakes are safety features.

The 'Reliant's' rear seat is wide enough for 2 persons. Luggage compartments have been enlarged. Note the dignity and good taste of cabin appointments.

Always considered the most beautiful, 'Reliant' interiors have been entirely restyled. See smart new handling of instrument panel — a finer note in airplane adornment.

Comfort for 3 persons in a cabin so distinctively styled that it cannot be matched even in planes costing many thousands of dollars more.

The "105's" 'Jewel Case' indirect... panel harmonizes stainless steel ... wood finishes, with control wheels ... in Fawn toned plastics.

The accepted Stinson 'Reliant' and the beautiful new Stinson "105" differ in price, size and performance. They do not differ in Elegance, Quality and Reliability. Both carry the prestige of the Stinson name. Both are styled in a delightfully refreshing manner which we believe surpasses all other airplanes in this important respect.

For 14 years Stinson 'Reliants' have outsold all other 4 and 5 passenger planes by a vast margin. They are widely used by Businessmen, Sportsmen, State and Governmental Agencies. Airlines, which are best qualified by experience to select the *Best* airplane, have been almost unanimous in buying 'Reliants'. Now we offer a newer and finer 'Reliant' retaining ... the proven Stinson advantages *PLUS* 25 new, extra value, features.

The new Stinson "105", for 3 persons, is so luxuriously appointed that ... sensationally low price will amaze you. It cruises at 105 miles per ho... with 25 mile to the gallon automobile economy. It is equipped with Sle... Flaps, Hydraulic Brakes and other features obtainable heretofore o... on planes costing thousands of dollars more.

For Quality, Style, Reliability and Value, insist that your next plane be ... Stinson. Write today for Stinson Plane News describing these *fine* plane...

STINSON AIRCRAFT DIVISION

AVIATION MANUFACTURING CORPORATION • WAYNE, MICHIGAN, U. S. A.

Prepare at PARKS AIR COLLEGE for a Successful Engineering Career in Aviation

Aeronautical Engineering Course
Offered by PARKS AIR COLLEGE
(108 Weeks)

Subjects

	Hours
BASIC COURSES:	
Mathematics	252
Physics	120
Applied Mechanics	120
Elements of Mechanism	60
Machine Design	60
Aerodynamics	80
Airplane Structures	120
Dynamics of Airplanes	60
Advanced Strength of Materials	60
Engine Propeller Characteristics	60
	992
APPLIED COURSES:	
Airplane Design	540
Stressed Skin Construction	180
Industrial Engineering	60
	780
MANIPULATIVE COURSES:	
Engineering Drawing	300
Aviation Mechanics:	
Metals	180
Welding	90
Instruments	90
Airplane Assembly and Alignment	180
Woodwork	90
Aircraft Finishing	90
Power Plant Designs: Construction and Installation	168
Power Plant and Accessory Overhaul Maintenance and Inspection Procedure	168
	1356
BACKGROUND COURSES:	
Air Transportation, History and Development	36
Fundamentals of Speech	24
Business Writing	24
Business Law	36
Civil Air Regulations	35
Spanish (elective)	144
Flight Training	20
Flight (ground work)	20
Flight Engineering	10
Navigation	20
Meteorology	20
Parachutes	5
	394
	3522

Statement of Purpose— *To provide aeronautical training so thorough, to maintain performance standards so high and, at the same time, to so emphasize the development of integrity, complete dependability and all-around good citizenship, that the aviation industry will wholeheartedly welcome their graduates, is the purpose of Parks Air College.*

AERONAUTICAL ENGINEERING training will open for you a greater variety of opportunities in aviation than will any other type of preparation. More than this, the present tendency is for some of the most responsible positions in the industry to go to men with engineering backgrounds. It can be expected that this tendency will continue.

Therefore, your own best interests require that in your consideration of the various fields of aviation you give careful thought to the field of Aeronautical Engineering. If, in your preparatory schooling, you have proven yourself reasonably proficient in mathematics and the other sciences, you can enter upon the study of Aeronautical Engineering with assurance of earning successful records both in school and after graduation.

Parks Air College invites your consideration of their Aeronautical Engineering program of training.

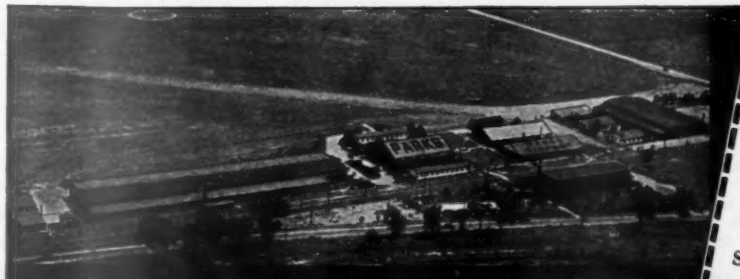
You will note that while 300 hours are devoted to the study of aeronautical drafting, it is much more than a drafting course. Drafting is thought of not as an end in itself, but as a necessary tool to be used by the engineer in his creative work.

You will secure a thorough grounding in basic courses and for a considerable portion of the course, 720 hours, you will study the application of basic principles to the solution of specific problems in Airplane Design and Stressed Skin Construction. Of distinctive value to you are the 1056 hours practical training in the maintenance of airplanes, engines and accessories, which you will secure in the large and exceptionally well equipped shops.

A detailed outline and description of each subject are included in the catalog — also complete information relating to the other three courses offered by Parks: Professional Flight and Executive, Aviation Operations and Executive, and Maintenance Engineering.

Because of your interest in aviation the catalog will gladly be sent to you. Send a postcard request or use the coupon.

PARKS AIR COLLEGE East St. Louis, Illinois



Fully approved by the Civil Aeronautics Authority. Accredited by the Illinois State Superintendent of Public Instruction.

PARKS AIR COLLEGE
East St. Louis, Illinois Section PA-7

Please send me details of Parks four major courses in commercial aviation training.

Name.....

Address..... Age.....

City.....

State.....

This IS THE TRAINING NORTH AMERICAN AVIATION DEMANDS OF THEIR *Aeronautical Engineers*

✓CHECK these prerequisites to a position in the engineering department of North American Aviation

1. *Training and ability in aeronautical layout and design.*
2. *A thorough understanding of aerodynamics and stress analysis.*
3. *Practical experience in airplane mechanics and construction.*
4. *Ability and knowledge to advance to positions of responsibility.*
5. *Training to carry through to completion an assignment in the manner required in modern production technique.*
6. *Broad training or experience which contributes to a more complete understanding of the coordination of aircraft plant procedure.*

California Flyers and North American—Neighbors on the CAA Test Field of the Nation's Aviation Capital.

HERE WHERE 55% OF THE NATION'S PLANES ARE ENGINEERED, CALIFORNIA FLYERS TRAINS MEN AS THE INDUSTRY WANTS MEN TRAINED

California Flyers engineering training extends beyond the development of general engineering ability and trains men to know from practical experience the many associated fields of production. It is directly geared to plant procedure. Here where more than half the nation's planes are engineered and constructed, California Flyers, in close cooperation with the industry, has created this practical and thorough engineering curricula for young men with the ambition to look beyond present horizons and to equip themselves to contribute to aviation's rapid advancement.

The engineering course is compact, complete and practical. It is covered in 14 months (2400 hours) of intense training in which all non-essentials have been eliminated. It includes all of the many required subjects from actual mechanics to design and stress analysis. It embodies aviation's most advanced engineering and production technique.

AIRPLANE DRAFTING COURSE—To the young man who desires to equip himself in a short length of time for a position in one of the most interesting fields of aviation, this course, in four months, covers all requisites not alone required to secure a position, but to advance in this rapidly growing division. This is not a correspondence course but supervised training directly under engineering authorities.

How you can start your career in aviation is interestingly related in California Flyers informative catalog. If you are seriously interested in making aviation your career, and are over 16, fill in and mail this coupon. You will find the time most opportune to start your training, for never before in the history of aviation has the industry been so under-manned in these important branches.

CALIFORNIA FLYERS, INC.

GOVERNMENT APPROVED

SCHOOL OF AERONAUTICS

LOS ANGELES MUNICIPAL AIRPORT, INGLEWOOD, CALIFORNIA

LEARN ABOUT THIS COMPLETE RANGE OF PRACTICAL CAREER COURSES

CALIFORNIA FLYERS, INC., School of Aeronautics, Dept. PA-7
Los Angeles Municipal Airport, Inglewood, California

Please send me your catalog and complete information on training, tuition, living conditions and employment opportunities. I am over 16 and interested in the subjects, checked:

Aeronautical Engineering ☐ *Airline Piloting* ☐
Production Mechanics (Aircraft sheet metal) ☐ *Aircraft Drafting* ☐
Instrument and Radio Beam Flying ☐ *Master Mechanics* ☐
Instrument Technician ☐

Name_____ Age_____

Address_____

City_____ State_____

TRAIN IN THE AVIATION CENTER OF THE WORLD

POPULAR AVIATION, Vol. XXV, No. 1, July, 1939. Published monthly by Ziff-Davis Publishing Company, at 608 S. Dearborn St., Chicago, Ill., U. S. A. Subscription $2.50 per year, single copies 25 cents; foreign postage $1.00 per year extra, except Canada. Entered as second class matter, January 24, 1933, at the Post Office, Chicago, Illinois, under the act of March 3, 1879.

Above: Primary Flying Instruction
Left: Riveting practice on a modern fuselage

GOOD NEWS!

Flash ▸ A 53 per cent increase in employment in a little over three months is reported by one airplane manufacturer. Employment is now 5,544 and is expected to reach approximately 10,000 by the end of this year Orders on hand around $39,000,000.

Flash ▸ Another airplane manufacturer reports payroll at 5,300 employees. This figure compares with 3,000 on January 1. Sales for 1938, listed at $10,274,503—nearly double 1937 sales.

Flash ▸ A backlog of better than three-quarters of a million dollars—the highest in its history—is reported by another company

Flash ▸ Still another company announces the building of a new plant with a capacity of approximately 350 personal transport planes a year, valued at about $5,500,000.

And so it goes! Every day there is more and better news about the growth and future of the aviation industry.

It isn't what *we tell you*, but what the *industry is doing*, that should make you decide to start *now* if you are interested in a career in aviation. *If you act promptly, you can join the summer classes starting July 5.*

Roosevelt Aviation School

Accredited by the U. S. Civil Aeronautics Authority . . . . Licensed by the State of New York

AVIATION TRAINING AT ITS BEST

FALL CLASSES START SEPT. 25, 1939

ROOSEVELT AVIATION SCHOOL—at Roosevelt Field, Mineola, Long Island, N. Y.

Without obligating me, send details of course checked:

☐ SOLO PILOT ☐ COMMERCIAL PILOT ☐ LIMITED COMMERCIAL PILOT
☐ PRIVATE PILOT ☐ AIRCRAFT SHEET METAL ☐ AIRLINE TECHNICIAN
☐ MASTER AIRPLANE & ENGINE MECHANIC ☐ MASTER AIRPLANE MECHANIC
☐ AIRCRAFT DESIGN & CONSTRUCTION ☐ COMBINATION FLIGHT-MECHANIC

SIGN AND MAIL COUPON TODAY

Name..... *Age*.....

Street Address..... *Town*..... *State*.....

P.A. JULY, 1939

The Birdmen's Perch

THINGS-TO-REMEMBER DEPT.

1. To shoot your brother-in-law
2. The date of your wedding anniversary
3. To write Whopper about Gulf Aviation Gas

You can cut the list down to two right away (to one, if your b. i. l. and a gun are handy) by authoring that tall tale today. Remember . . . the monthly champ liar gets a swell diploma. Mail yours to

MAJOR AL WILLIAMS, alias "Tattered Wing-Tips,"
Mgr. Gulf Aviation Products, Gulf Bldg., Pittsburgh, Pa.

SPECIAL CITATION

On March 29th the National Safety Council bestowed Certificates of Award upon eight domestic airlines for their outstanding safety achievements:

American Airlines, Inc.
Eastern Air Lines, Inc.
Pennsylvania-Central Airlines Corp.
Braniff Airways, Inc.
Continental Air Lines, Inc.
Inland Air Lines, Inc.
T. W. A. (Eastern Division)
United Air Lines

Our congratulations to all for a fine record. And we're especially proud that the first three mentioned are Gulf clients—Eastern and Pennsylvania-Central being regular users of Gulf Aviation Gas and Gulf Airline Oil, while American buys gasoline from us in certain territories.

ADVICE TO THE LOVELORN DEPT.

Dear Auntie Wing-Tips:

My boy friend swears horribly because the bearings in his airplane motor keep burning out. What *shall* I do?

"*Wondering*")

"WONDERING:"

Be tactful. Secretly fill his pockets with Gulfpride, the only oil refined both by conventional methods and by Gulf's exclusive Alchlor process. He'll be amazed, my dear, when you tell him this patented *extra* process removes *more* sludge and carbon-formers from the 100% Pure Pennsylvania.

Auntie (Versatility) Wing-Tips

P.S. If, after you (and handy Gulfpride) have removed all excuse for his vulgarities, he still swears, try putting cotton in your ears.

P.S. jr. As a last resort, get a new boy friend.

SCRAMBLED SPELLING

This month we have a different type of problem contributed by Bob Newill of Dayton, Ohio. Many thanks, Bob, and we hope our readers don't take as long to unscramble the following plane names as we did.

1. RAINWER. 2. SEWRBERT. 3. CHELEOKD. 4. YESKVERS. 5. BECTFEARHC. 6. SLOCNODADEIT. 7. YRRTOCALFTA. 8. COMOPNOUE. 9. RATSNAP. 10. TNOSNIS.

We've got the list of answers handy so send in yours to Prof. Wing-Tips to be checked.

THIS MONTH'S WHOPPER

Dear Major:

Quite a few years ago while barnstorming, I gave an exhibition at a place called Texaloosie. After the show a couple of brothers wanted me to test-hop something they called a Flying Flea powered with a 1½ h.p. Whirlo washing-machine motor.

I had a little trouble getting it off so they called in a friend who had a secret preparation, claimed he had put a couple of drops on an old alarm clock and it gave him enough power to run a 16-inch centrifugal irrigation pump. This fellow came over with a ketchup-bottle full; said that was all he'd been able to get from the Gulf Oil Co.

About dusk I put a few drops of his stuff in the tank of the Flying Flea. There was a terrific whooish! We stood around stunned, then everybody looked straight up and there in the sky was the prettiest single set of fireworks anybody could hope to see. The Flying Flea had skyrocketed up and with a *poom* exploded into about 1000 smaller Flying Fleas which skyrocketed up and exploded into still smaller Flying Fleas until the whole sky was aglow with midget Flying Fleas. Pretty soon the whole spectacle faded away toward the west.

Several years later while visiting friends in San Francisco, I felt something zoom up my back. Listening intently, it seemed I recognized the drone of the little Whirlo. Mine host suggested I jump into a bath tub and shake, which I did. Sure enough there was one of the little Flying Fleas banking around the tub like six entrants in an international speed race.

"That's a flea," he said.

"You're telling me?" I filled the tub up with water.

"California is full of fleas," he contributed.

"But this one is different," I said: "this is a Flying Flea." And to prove my point I let the water set for an hour, bottled it up and sold it as cleaning fluid.

Now if that stuff I put in the original Flying Flea is what is now know as Gulf Aviation Gas . . . boy, Major, YOU *GOT* SOMETHING! *Yours,*

Tom P. Mathews

Gulf Oil Corporation and Gulf Refining Company . . . makers of

GULF **GULF AVIATION PRODUCTS**

Dallas Aviation School and Air College

GOVERNMENT APPROVED

MAJOR W. F. LONG, President

LOVE FIELD » DALLAS, TEXAS

C. E. HARMAN, Secretary-Treasurer

SHORT ON TALK BUT LONG ON PERFORMANCE

THIS school makes no loud talk, as usually the fellow who talks the loudest has the least to offer. We have here what it takes to make expert pilots and mechanics—and at a reasonable cost—and under the most favorable conditions in aviation in the country. Our graduates are the equal of the graduates of any school in the country and we are of every assistance to our students throughout their courses in order that their courses may be a decided success; all we ask is cooperation.

THESE are Aviation Times and aviation is being builded by the youth of this country. It is a young man's business. You will make no mistake in entering this fascinating industry as thousands of places are yet unfilled and there is room at the top for anybody who will qualify himself for the places that are yet to be filled. You save time, money and expenses at this school because our courses are shorter and the answer is the same.

THIS school has graduated more blind flying students than any other school in the country and each and every one of them is now profitably employed in their chosen profession.

BOARD AND ROOM AT THE SCHOOL

COME TO DALLAS AND WIN OUT

You Can't Buy More . . . So Why Pay More?

COME TO DALLAS!

Dallas Aviation School and Air College

Love Field

DALLAS, TEXAS

Please send your 1939 catalog to:

Name_____

Address_____

City_____

State_____ Age_____

THERE still are a few in the aviation industry who take it for granted that they can tell us what—and what not—to print. We have been amazed more than once at certain men who have the crust to *tell* us not to print certain things simply because it doesn't happen to suit them. Frankly, we've been taken aback at this audacity, for we've been under the impression that such a conception of journalism was a thing of the past. We reckoned too hastily. These "censors" have been blunt. We can be, too.

POPULAR AVIATION's editorial policy is, we think, progressive. It is intended *only* to suit this magazine's readers and to promote the knowledge and welfare of aviation as an industry. Our circulation as compared to the circulation of certain other aviation magazines prone to censorship brilliantly bears out the wisdom of POPULAR AVIATION's editorial policy. Our readers are getting what they want, not what someone thinks they should have. We shall keep right on giving them what they want. We have no intention of hurting aviation as a whole. But, when something in the industry needs airing we are probably the only publication in the business with the gumption to tackle the job. Yet, we are not crusaders; generally speaking, we dislike that sort of thing. We seek and print interesting, constructive and timely articles on any phase of aviation anywhere. *Any* article we honestly think should be printed in POPULAR AVIATION will be—and no self-appointed censor will tell us otherwise. Suggestions and constructive criticism have been and always will be vigorously sought. The great majority of our friends in the industry know that.

* * *

COLONEL LINDBERGH has come home. We're glad he's back and we sincerely hope he'll settle down to a quiet and inconspicuous family life—and get out of our hair once and for all. Perhaps we're straining a few hero-worshipping illusions in saying that about aviation's outstanding male Garbo. But, if we can believe what we've heard, we don't think we're straining many. Lindbergh has succeeded in getting himself thoroughly disliked in aviation's inner circles. Some of that dislike is sheer jealousy. But a lot of it is well founded and he himself is solely to blame. We can't very well blame veteran Army airmen for grumbling when Lindbergh shows up at an Army air base

(*Continued on page* 82)

POPULAR AVIATION

Volume XXV JULY, 1939 Number 1

CONTENTS

FEATURES

Anti-Aircraft Failed in Spain 10
American Export Airlines 12
'Safety' Planes 16
Hampden Takes Its Bow 19
It's Not All Hokum! 20
Are Flying Boats the Answer? 24
"Shorty" 27
Streamlined Debut (full page photograph) 29
The Case for 4 Engines 30
Is the Dirigible Doomed? 32
I Learned About Flying From That!—No. 3 35
He Won't Stay Down 37
Flying His Way Through College 39
Meet Mr. Wilson of the Air Corps 40
Bugs in the Wind 44
They Almost Beat the Wrights 47
Amazing Miss 49
The Man Under the Hood 51
He Designed a Tiger 53
10 Goal Pilot 55
Personalities 57
This Month's Model 58

Cover Photograph: Aeronca seaplane, by Gordon Sear Williams

Copyright, 1939
ZIFF-DAVIS PUBLISHING COMPANY

Editorial Offices 608 S. Dearborn St., Chicago, Ill.
Member of the Audit Bureau of Circulations.

POPULAR AVIATION is published monthly by the Ziff-Davis Publishing Company at 608 S. Dearborn St., Chicago, Ill. William B. Ziff, Publisher; B. G. Davis, Editor; Max Karant, Managing Editor; B. Carl Capehart, Advertising Manager. Herman R. Bollin, Art Director. New York Advertising Office, 381 Fourth Ave. Subscription $2.50 per year; single copies, 25 cents; foreign postage $1.00 per year additional, except Canada. Contributors should retain a copy of contributions. All submitted material must contain return postage. Contributions will be handled with reasonable care, but this magazine assumes no responsibility for their safety. Accepted material is subject to whatever revisions are necessary to meet requirements. Payments will be made at our current rates upon acceptance and, unless otherwise specified by the contributor, all photographs and drawings will be considered as constituting a part of the manuscript in making payment.

WOULD YOU COME TO CURTISS-WRIGHT TECH IF WE GUARANTEED YOU A POSITION IMMEDIATELY UPON GRADUATION, with an opportunity to advance rapidly into supervisory positions with greater responsibilities and bigger pay?

Naturally, we can't be expected to do this for obvious reasons—one of which is YOUR capabilities, of which we know nothing. We do not now, nor have we ever guaranteed or even promised positions to our graduates. BUT—after all, why should we?—it is entirely unnecessary as well as unethical. The record of Curtiss-Wright Tech graduates, over the years, is all the guidance or guarantee anyone needs who is ambitious. For years, practically all Curtiss-Wright Tech graduates have obtained immediate employment and have steadily forged ahead into the bigger jobs that are only open to those with proper training. THE SAME OPPORTUNITY IS STILL OPEN TO YOU.

The newspapers are full of the proposed United States national defense aviation expansion program now just getting under way. Tremendous plans are being made for capacity production, WHICH MEANS TRAINED MEN WILL BE IN DEMAND AND AT A PREMIUM. Aviation is a highly specialized business and there is no chance for advancement for the untrained or poorly trained man, since he is the last one in aviation to get a job and is the first one to lose it. Opportunity is positively hammering at your door. There never was such a chance in aviation for you—there may never be another such chance.

"Don't put off until tomorrow what you can do today." Protect your future with Curtiss-Wright Tech's PROVEN training and enroll now before you "miss the boat."

We are not training our students to drive rivets or do drafting all their lives. Curtiss-Wright Tech training is all designed to prepare its students to occupy responsible supervisory positions. Our hundreds of successful graduates prove that Curtiss-Wright Tech training gets results and always pays—it has provided them with a profitable occupation and a secure future career. Curtiss-Wright Tech's two major courses, AERONAUTICAL ENGINEERING and MASTER MECHANIC, are complete career courses and are carefully planned to train you in advance for the highest position you ever expect to occupy.

OFFERING SPECIALIZED AND PROVEN TRAINING IN

AERONAUTICAL ENGINEERING & MASTER MECHANICS

CURTISS WRIGHT TECHNICAL INSTITUTE

UNDER PERSONAL SUPERVISION OF MAJOR C. C. MOSELEY SINCE ITS ESTABLISHMENT IN 1929

GRAND CENTRAL AIR TERMINAL, GLENDALE (Los Angeles) CALIF.

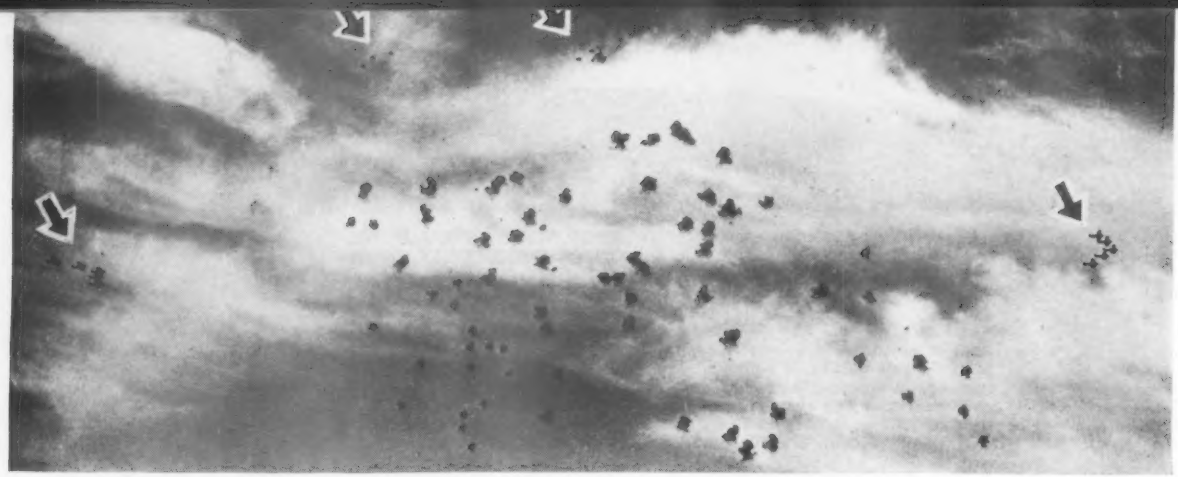
Without cost or obligation send me full information and catalog on the course checked below:

Major Career Courses	Supplementary Courses	Home Study Courses
☐ AERONAUTICAL ENGINEERING	☐ POST GRADUATE ENGINEERING	☐ AERONAUTICAL DRAFTING
☐ MASTER AVIATION MECHANICS	☐ AIRCRAFT SHEET METAL	☐ BLUE PRINT READING

NAME_____ Age_____ Date I plan to Enroll_____

ADDRESS_____ City_____ State_____

PA-7



"Where there were only anti-aircraft guns defending, enemy bombers had little respect for us." Much of the time they would come over unescorted by pursuit convoys. Arrows show planes passing shell bursts.

★

FRANK HADESBECK

tells why

Anti-Aircraft *Failed* in SPAIN

★

Here is the answer to an important question, particularly in these war-like times. The author presents some unusual, enlightening facts.

I HAVE just returned to my home here in Regina, Saskatchewan, Canada, after serving 14 months with a Loyalist anti-aircraft battery in Spain. Naturally I'm very much interested in the general controversy about the effectiveness of gun fire from the ground as an air raid preventative. Herewith I want to tell you my personal opinions and some of my experiences in fighting against the airmen of General Franco.

Much as I hate to say this I must, in truth, tell you that anti-aircraft fire has little value. I think the best defense against air raiders are defensive fighting planes. Let me cite you the statistics of our own battery. My own group, consisting of three batteries with four guns in each battery when at full strength, shot down 73 bombers and two fighters in about 26 months of action. We fought during that time in more than 400 air raids. During the months I was with the battery we were in 150 air raids and

The real benefits of anti-aircraft were found with light guns like these machine guns. Properly used, they made a fair showing against the enemy.

were directly bombed ourselves 34 times.

You can see that we were not very effective. Most of the planes we did shoot down were at the front when they were flying very low. When the bombers flew high we were not effective at all. Take the port of Valencia for example. There were always four batteries there and sometimes six. They fired on an average of three times a week. Yet during the entire duration of the war there was only one bomber brought down there. I know this to be true because I was stationed there for three months myself.

I can only guess at the number of shells fired during the raids in which I participated myself. It's safe to say that only about one in 25,000 of the heavy guns ever made a hit. For the lighter guns and the machine guns the chances of getting a hit were only about one in 100,000. One reason for these figures was that the bombers never came over in large numbers. About 15 at once was the limit over the towns and industrial areas. They would sometimes come over in greater numbers at the front.

The largest number of bombers and fighters I ever saw in action at one time was at Onda on the Lavante front. It was on June 13, 1938. I recorded it in my diary as follows:

"I will never forget this day if I live to be a hundred. Though we were not bombed directly, it was the duration of the bombing that impressed me. For two and a half hours the bombers came over in groups of nine and bombed our front lines and the artillery positions in front and to the right of us. We counted 176 bombers and nearly twice as many fighters. This was the first time we ran out of ammunition. We fired 750 shells from the heavy guns and about 1,500 from the light guns, but never made a hit. Our guns are badly worn and the crew is nervous. We're not shooting as well as we did at the beginning of the year."

Our guns were of the latest types then available and we were given plenty of ammunition. We had, at various times, the Russian S.K. 7.62 cm. L55 gun; several stationary batteries of Czech Skoda 8.5 cm. and some British Vickers 8 cm. guns. These were all the heavy types of cannon firing shells weighing between

(*Continued on page* 60)

Enemy Savoia-Marchetti (Italian) bombers would fly over high and lay their eggs with little respect for the anti-aircraft. Below is a freight train they caught up with.

This light one-man anti-aircraft machine gun was best against ground-strafing planes.

William H. Coverdale is the self-made millionaire who heads American Export.

It's up to Durston Richardson to set up Export's airline and make it run safely.

Jim Eaton, who knows his ocean airline business, is executive vice-president.

★

TRANSATLANTIC NEWCOMER

by SPENCER GREGG

Three tough, air-minded business men with plenty of cash have started an airline well worth watching

IF you plopped Durston G. Richardson down in the middle of a Guatemalan jungle armed with nothing but a pocket knife and some usable profanity that he could lay a practiced tongue to, he would emerge a few weeks later, freshly shaven, carrying a deed to the country.

That is information only incidental to our story, but it serves to show what kind of a man has become top hand in the only airline in the history of aviation which proposes to start from scratch and fling an operation across 3,000 miles of open ocean.

Richardson looks rather silly sitting there behind a highly polished desk in the heart of the nation's biggest city, doing things with pencils and sheets of paper which presently should materialize into a transoceanic transport line. He looks silly because he is a hard-fisted hombre who started his kindergarten work in flying back in the days when a World War instructor thought nothing of denting a student's skull with a wrench if the fool jammed his foot against right rudder in the midst of a port bank. Richardson sits there with his pencils and paper, flanked by a comely secretary, itching for the day when he can go out to Floyd Bennett Field on Long Island and bellow to the skipper of an American Export Airlines flying boat: "All right, get that big piece of tin out of here—and don't go making eyes at any of those native wenches in the Azores!"

Richardson is operations manager for a company which proposes to bridge the Atlantic to France and fly far into the Mediterranean, with great metal wings marked "Made in America." This is the story of that venture. . .

More years ago than he cares to remember a youngster named Willie Coverdale was born in modest circumstances in a little Canadian community on the banks of the St. Lawrence. If Willie was not born with a silver spoon in his mouth, he had the makings of one. More than that, he had a Midas touch. Engineer and business man, William H. Coverdale had made a fortune—and lost it—at a time in his life when most young men are trying to figure out a career.

One of the favorite stories about him impinges on the hard times of the year 1907 when he walked the streets of New York, fingering a thin dime in his pants pocket.

"How much?" he asked a street peddler, pointing to a sack of peanuts and an apple.

"A dime," replied the peddler.

Coverdale handed it over. He was broke but he had his dinner.

Two years later he was drawing $100,000 a year.

This same Coverdale, a director in numerous corporations, coiner of fortunes for himself and others, president of a transatlantic steamship line, now proposes to establish an airline to Europe which eventually expects to offer non-stop service from the American mainland to cities of the Old World.

There has been some jeering, but you can't jeer assets of several million dollars without making yourself look fool-

Survey flights between the United States and the Mediterranean countries will start soon with this Consolidated boat. A commercial version of a Navy patrol bomber, American Export's ship cost $200,000.

ish. Coverdale has a lot to learn about flying, but he knows business and he knows men. He picked Jerome C. Hunsaker, head of the department of mechanical engineering at Massachusetts Institute of Technology and one of the country's outstanding research scientists, as aeronautical consultant to American Export Airlines. He picked James M. Eaton, one-time head of Ludington Airlines and former general traffic manager for Pan American Airways, as a vice president. And of course, on the recommendation of Eaton, he picked Durston Richardson who has taught flying, dusted cotton and for ten years held down one of the toughest assignments in aviation—managing operations in Pan American Airways' western division where the jungles are interminable and every cloud hides a mountain as hard as flint.

American Export Airlines, a subsidiary of American Export Steamship Lines, is starting from scratch. Just about 30 months ago Tommy Hitchcock, the wartime flyer, business man and polo player, approached Eaton.

"What about starting an airline over the Atlantic?" asked Hitchcock quizzically.

Eaton nodded. "Airplanes can be built for it," he said.

An electrical engineer and graduate of the University of Maine, Eaton had taken his first flight in 1912. A year later, with Tony Janis, he started what he calls the first commercial airline in the world. It was in Florida. Its lone piece of equipment, a Benoist flying boat, sported an engine in the hull which whirled a wooden prop by a chain drive. The tariff was four cents a pound for each passenger on the hoof and the Benoist faithfully churned the air between Tampa and St. Petersburg once each morning and afternoon.

Eaton worked at that for a year. Fourteen years were to elapse before he again got his fingers into flying. A specialist in engineering management, he had charge of purchasing all the materials for the American Ordnance Base Depot in France during the war. Returning to the United States, he took charge of materials purchasing for the Hog Island shipyards.

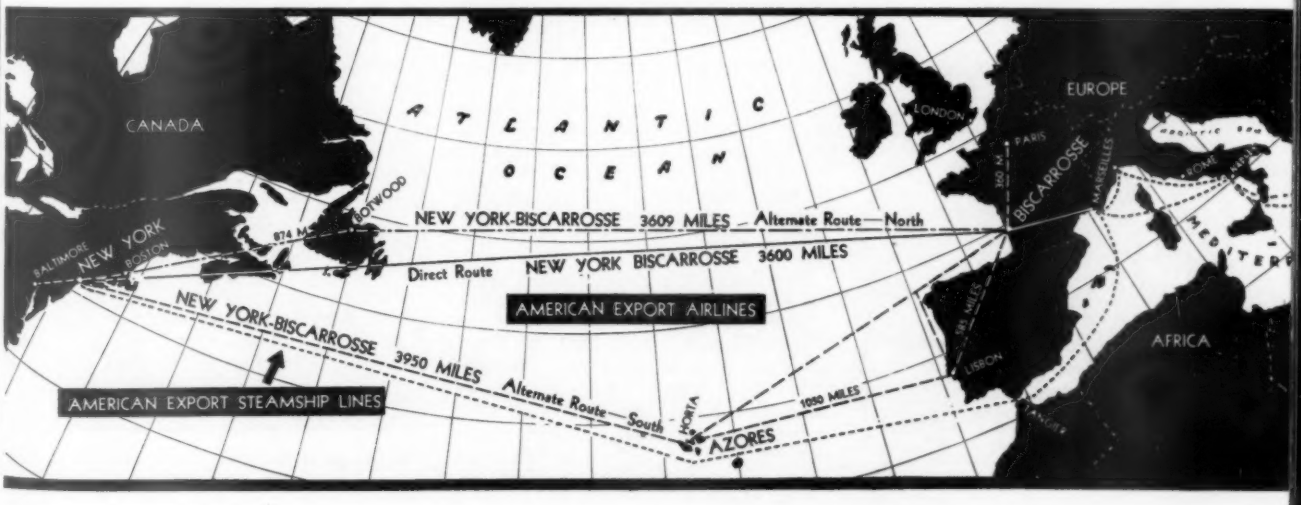
And—an interesting sidelight—14 of the freighters now being used by American Export Steamship Lines were built at that time at Hog Island.

Eaton's work for Pan American is a well-worn story. He laid out an organization chart and suggested expansions when Panair was shuttling back and forth over that 90 miles separating Key West from Havana. He knew the Caribbean and he knew the kind of equipment that was needed to push that puny operation to Nassau, Jamaica, Haiti, Santo Domingo, Puerto Rico and Panama. In four years he watched Panair's route mileage jump to 19,000.

The Ludington venture was a success for everybody except the man who rang the cash register. Its New York-Washington merry-go-round reached a peak load of 300 passengers a day, but Eaton concluded it was an unsound business without a mail contract. He sold it.

When Hitchock rapped on his door, Eaton was ready for him. He had devoted himself to a study of airplanes for transportation. His argument was that a plane had to be built for a given job. He took Coverdale to the Glenn L. Martin plant at Baltimore. There the engineering and financial genius of dozens

The lowest dotted line on the map below shows AE's ship routes. Routes above that are the airline's.



This is the present air base at Biscarrosse, France. Now in use by a French flying boat concern, the Biscarrosse base is a 3,600-mile bee-line flight from New York.

of successful business ventures clapped his eyes on a modern transoceanic transport, up close, for the first time.

Today, in a Wall Street office a few blocks from the headquarters of his steamship and airlines, Coverdale can be seen getting up from his desk several times a day and strolling over to the window to watch the seaplanes skimming in to a landing on the turbid waters of the East River.

On that day 30 months ago when he walked into the Martin plant, Coverdale decided wings and engines could be harnessed to the needs of commerce which had outgrown the caterpillar crawl of surface boats.

"For the past year and a half," he wrote members of the Senate and House in December, 1937, "company engineers and transportation experts have been engaged in an international survey extending over its entire route, from the United States to Portugal, Spain, France, Italy, Greece, Egypt and other countries touching on the Mediterranean and Black Sea.

"The survey established the fact that 'superliner' type steamships are totally unsuitable and uneconomic in the face of the great strides that are being made in the development of the large flying boats."

Patrick J. Byrne, borrowed from the U. S. Navy, will fly AE's 15-ton survey ship.

And this is his plan: to carry most of the mail, express and passengers, normally assigned to his steamships, in giant flying boats, leaving the freight and passengers with more leisure time to move by the vessels which ply the Atlantic with turbines growling 24 hours a day, every day in the year.

American Export's project is a-building slowly. Only one plane, a 15-ton Consolidated, twin-engined flying boat which stood the company $200,000 as it rolled off the assembly line of the factory at San Diego, has been purchased to date. Being test-hopped now, the ship is liable to be on its way to Europe on its initial survey flight by the time you read this. The fact that Panair at about the same time will be starting regular passenger flights by way of Botwood, Newfoundland, and Foynes, Ireland, doesn't bother Coverdale, Eaton et al in the least. All in good time, they say. By September or October they expect to start fast mail schedules with several twin-motored pieces of equipment into the Mediterranean from New York.

The first ship, as everyone knows, is a commercial adaptation of the Navy patrol boat which regularly takes in stride hops of 2,500 to 3,000 miles non-stop from San Diego to Hawaii or the Canal Zone. That the Navy let American Export order the plane is added evidence that the gold-braided officials in Washington are anxious to help business do a job which they themselves cannot attempt for fear of offending certain European militarists who shall remain unnamed.

The Consolidated boat has a span of 104 feet, a length of 65 feet, 1¾ inches, a wing area of 1,400 square feet and can accommodate a useful load of 15,000 pounds. The power plants are twin P. & W. Wasps of 1,200 horsepower each for takeoff. She will carry 1,750 gallons of gas for a range of 4,000 miles, and will cruise in still air at 170 at an altitude of 10,000 feet.

Patrick Joseph Byrne, borrowed from the Navy, will be the skipper. One of only four chief boatswains in Naval aviation, he has flown 75 different types of military ships since 1917 and has spent 7,500 hours in the air as a service pilot. That does not count almost 600 hours of civil flying. He made the first West Indian air cruise in 1919, and has flown in every clime from Pensacola to Tasmania. Just to top things off, he once looked over the Galapagos islands, off the coast of Ecuador, from the air.

With Byrne, as crew will be First Officer T. S. Terrill, co-pilot and navigator; Second Officer M. C. J. Doyle, engineer; Third Officer W. W. Ehmer, radio man, and R. B. Carlson, assistant engineer. Ford Studebaker, prominent air-radio expert formerly with the CAA, is chief of communications.

For communication, Studebaker installed a new-type radio in the Consolidated. Most transmitters used by the domestic airlines are of the quick-shift type. Frequencies can be changed in seconds. Up to now they have not been adapted to transoceanic use. With two transmitters and 16 channels, Radioman Ehmer will be able to shift frequencies in a maximum of four seconds. The other day the Consolidated "worked" a Long Island station as it sat on the ramp at San Diego.

Well, what is going to come out of all this? That's a hard nut to crack, especially in talking with Eaton. Mail ships will be ready in the fall, he says. That means they are already in the works or are of standard design, with the jigs ready to turn them out. But just what they are, he prefers not to say. When will American Export begin carting passengers to Europe? In from two years to two years and a half. In what? The passenger ships will gross about 35 tons and accommodate no more than 20 berth passengers for maximum speed. What about these non-stop reports?

Right there you begin encountering Eaton's ultra-secretiveness. He points out that the harbor and weather conditions at Horta do not encourage the use of that port as a regular stopping point. He adds

In charge of the survey ship's elaborate radio will be Third Officer W. W. Ehmer.

that nobody ever said American Export would carry passengers in flying boats, leaving the inference that landplane operations across the vast reaches of the Atlantic are more than possible. Panair is planning on using a Boeing "307" landplane for mail cartage to Europe, so some sort of a precedent will be set.

Whether American Export Airlines will eventually operate flying boats or landplanes remains to be seen. The fact remains, however, that the company has expressed more than casual interest in a commercial version of Consolidated's four-engined XPB2Y long-range patrol bomber. Although it is possible that a second modified twin-engined PBY will be bought, Export is presumably keeping one eye on the new "secret" twin-engined ship now being tested by Consolidated. Meanwhile, there are those who see Export seriously considering the giant 100-passenger design evolved by Consolidated although the purchase of such equipment, most airline experts agree, is in the not-too-near future.

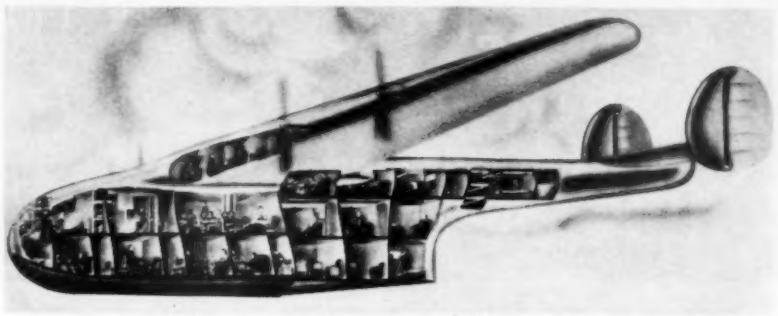
Export's experimental work has been financed to the tune of some $400,000 with about $200,000 of that already gone into its first twin-engined survey ship. That the new airline is well-backed is obvious. As of August 31, 1938, American Export Steamship Lines had resources of $9,037,263.95—and the steamship line is just one of Coverdale's many businesses. The airline's $400,000 assets are, Eaton admits, "extremely fluid"; in other words, it would not be at all impossible for the airline's financial bulwark to jump to almost any reasonable figure overnight (Coverdale once said he was ready to sink $5,000,000 into flying boats). Coverdale, then, is determined to get his airline going. He visualizes—and quite logically—that his line should make a neat profit from the carrying of mail alone, pending such time as larger passenger-carrying equipment is invested in. Plans for American Export Airlines, then, are rather ambitious. At first it is intended to serve only the western Mediterranean. From there the company expects to expand into the eastern Mediterranean and the Black Sea countries. American Export's 18 steamers already serve 73 ports in 14 countries; it is known that aircraft landing facilities have been obtained in "most" of those countries.

The United States Navy naturally is noncommittal about it all, but observers insist the Navy has more than a passing interest in the success of American Export Airlines. Boatswain's Mate Byrne, pilot of the line's trail-blazing flying boat, has simply been borrowed from Naval patrol squadron 14 attached to the *U.S.S. Owl*, a Naval mine sweeper recently converted to a seaplane tender. Boatswain's Mate Byrne is said to be still on active duty and merely assigned to Export on a "special mission."

Meanwhile, in addition to the radio stations aboard each of American Export's steamships, it is reported that Export has completed arrangements to "home" its airplanes on all RCA and Mackay radio stations in the United States and abroad.

As this goes to press, it is quite possible that Boatswain's Mate Byrne and his crew will have flown Export's first Consolidated boat across the United States from San Diego to New York. Once in New York, test flights preliminary to the first Atlantic crossing will get under way. It is believed now that there is a possibility that the takeoff for the first survey flight will be from Boston.

Recently "unveiled" was this big new Consolidated design, possibly Export's next equipment purchase. This ship is powered with "secret" 2,000 h.p. Wright "Cyclones."



This is Consolidated's "dream ship" version of a 100-passenger ocean liner. It is this type of equipment that already is being planned for lines like American Export.

All that Eaton will commit himself to for the present is that survey flights are prepared for.

American Export figures that its big transports will have double the safety measures of the ordinary transoceanic plane. The steamship company operates 18 boats from America into the Mediterranean. At no time will American Export planes be more than 500 miles from one of those surface boats. Each vessel is a floating weather station, equipped to transmit meteorological reports hourly to the planes speeding above them.

A few months ago American Export and Panair seemed to be working at being mad at each other. Export indulged in name-calling. Panair, said Coverdale, held a monopoly on the Atlantic. Panair promptly denied it. Then the two companies got together and "divided" Europe—Panair would have London, Holland and the Scandinavian countries; Export would operate in Germany, France and the Mediterranean.

"Oh yeah?" said the Civil Aeronautics Authority, and threw out the agreement as being in restraint of competition.

Export says that's fine. The agreement cramped their style.

The only person who isn't bothered by inter-company squabbles is Richardson. He has been through too much competition to lose any sleep over it. Besides, he has had tougher jobs. He remembers the time, for instance, when he was civilian instructor in the Cuban air force. His Cuban students wouldn't learn to throttle down their motors to cruising speed.

"Now look," he explained, drawing on a blackboard. "This is the world. If you fly full throttle, all your gas will be gone in no time. But if you cruise, you can go up to 3,000 feet and hang there, and pretty soon you can look down and there you will be, 3,000 feet over New York."

"Oh, no," objected a student. "You would be more than 3,000 feet on account of the curvature of the earth if you flew in a straight line from Havana."

What can a man do in a case like that?

END

Meteorologists on Export's steamships will play a vital role in the company's airline.

Tricycle gear like that on this Waco "N" are considered "here to stay."

'SAFETY' PLANES

by

FRANKLIN T. KURT

The Civil Aeronautics Authority believes private flying needs a stall-proof, spin-proof airplane.

F. T. Kurt

RIGHT from the start we should say that we don't like the title of this story. We prefer the term "simple planes" to "safety planes," for the latter implies that some airplanes are safe and others are dangerous. There is no such division of the sheep from the goats and there never will be. Safety is not a positive quality, only a relative one. As the down-east fisherman said about whiskey—"Ba-ad whusky? There ain't no sech thing as a ba-ad whusky—but some whuskey's better than others."

One cynic in the business has said that the only safe airplane is one that has just burned up. The analysis of that statement implies nothing against airplanes but only condemns the way they are flown. It is true that the pilot's manipulation of an airplane will always be its last measure of safety. However, the improvement of our pilots is a eugenics problem and they could only be improved by a very few per cent at the expense of prodigious effort in three or four generations. The improvement of the airplane can be done almost at once. Big strides are already accomplished and a thousand ideas now are awaiting test.

We are stealing the words of a well-known engineer when we say that no vehicle which moves with a fair speed can be rated as safe, because it possesses enough energy to be self destructive if its course is misdirected. If we can reduce or prevent the tendency of the plane to leave "the straight and narrow" so that its course is not misdirected, we have at least improved its relative safety. A safe, or shall we say "simple" airplane is one with flight characteristics that excuses comparatively inaccurate flying by the pilot that flies it. That is, it permits the errors and still adheres to a controlled state of flight. That is the best explanation of the problem we have heard.

There are several methods of attack in creating an aircraft with these features. We can improve our current type of airplane. We can go to a tail-less or tail-first or other unorthodox type. Or we can go to a rotary winged aircraft.

Enough work has been done in simplifying the conventional type of plane so that the procedure now falls into several well defined channels. The subordination of the stall and the complete elimination of the tail-spin are the first requisites. Accidents from stalls or spins still account for the single largest column in the accident tabulation. Since the spin follows or results from the stall as soon as there is a little yaw or turning introduced, they are practically the same problem. A spin can be thought of as a condition where the inside wing is stalled and the outside wing is lifting —always lifting the ship back into a vicious tight uncontrolled downward circle. At least it is not controlled by *normal* responses.

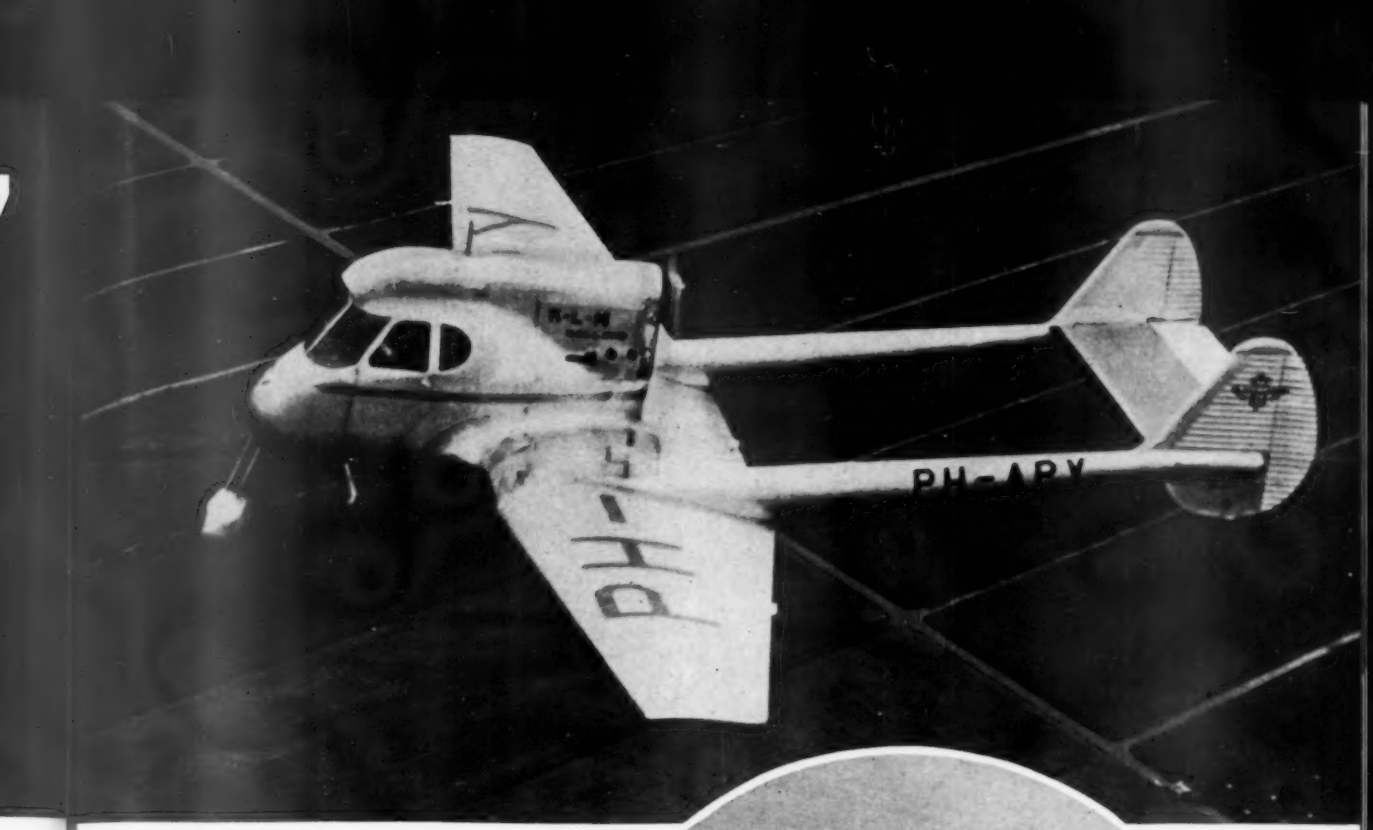
These requisites can be accomplished by limiting the effect of the tail. There is no reason why we should supply a pilot with more control than he needs and then ascribe the crash to "pilot error" if he happens to use too much. If the up-travel of a well designed elevator is reduced judiciously, a point may be reached where there is ample elevator control available for landing purposes and yet not quite enough to stall the wing.

This goal is further secured by controlling the stall over the wing through careful design so that it "lets go" at the central portion first and does not lose its lift at the tip until the very end, if at all. Most conventional planes either stall all over at once or at the tips first after which only alert control will prevent the spin that wants to develop.

Controlling the stall this way can be done by a number of devices. The best known are the slot (where an opening is built into a wing) and the slat, where an opening is created at the leading edge behind a curved slat held slightly ahead of the wing. In either of these methods the air pouring through the opening is curved downward over the upper surface of the wing so much that it delays the stall until the wing has been raised to a much higher angle of attack at which it meets the airstream.

Other methods are the use of washout, in which the wing is twisted so that the wingtip section has a lower angle of attack than the center, and by changing the airfoil section between the root and the tip. Even changing the wing-root fillet offers considerable control and, of course, the use of flaps profoundly effects the airflow. But these require the brains of the pilot to apply and are not automatic.

Misuse of the rudder is as common a cause of spin as using too much elevator. This is because a stall and a turning motion lead to a spin; the rudder supplies the turn. A skidded turn is one in which too much rudder is used while the plane is not banked enough. The



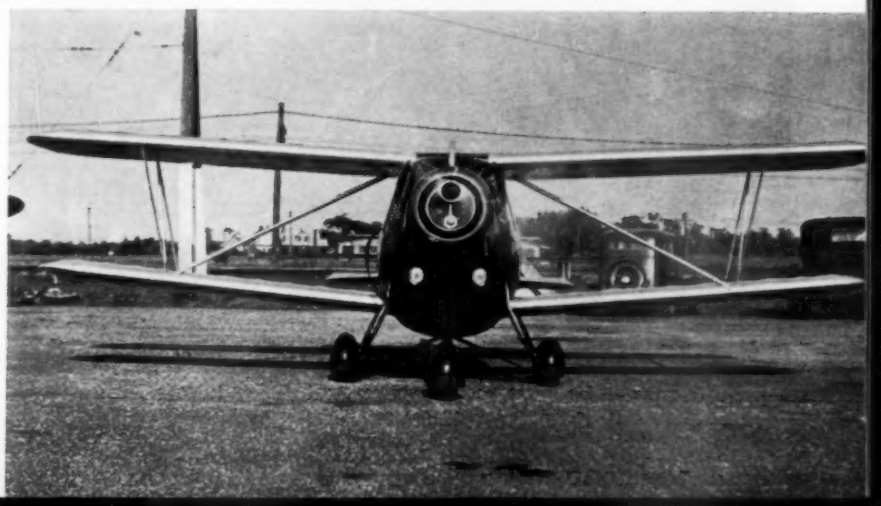
This is the much-publicized Stearman-Hammond.

inside wing is then retarded and the outside wing is speeded up. The former gets less lift and the latter more. If the plane is then slowed up until a stall is about to occur, the poor inside wing doesn't have a chance and down it drops. Beginners are inclined to make skidded turns near the ground because they do not yet like to see the steep bank at low altitudes.

We could prevent this kind of accident if we could prevent the pilot using too much rudder. In fact the rudder is barely needed on good turns anyway. The ailerons produce the bank and, with a little more care in design, they can be made to do the whole thing and the rudder can be eliminated—providing, of course, it is not needed on the ground. But that is a landing gear problem. Conventional airplanes with elevator, aileron and rudder are called three-control airplanes. When the rudder is eliminated they are called two-control ships. This can be done by enlarging the area of the vertical fin. Usually two fins are used and they have such a strong "weather-vane effect" that, as soon as the ailerons have banked the plane, they push the tail around and induce the nose to swing into the turn as if rudder had been applied. When these are carefully proportioned against the dihedral of the wings the airplane will make a perfect turn with no trace of skid or slip.

These two improvements, when they really get out into service, are sure to reduce the stall and spin accidents. In fact, in rudimentary forms, these features

Curtiss' "Tanager" was a 1929 attempt to develop a truly fool - proof design.



The Gwinn "Aircar" was patterned like an automobile, even to headlights and a horn.

This is the latest "safety" plane, developed by the Engineering and Research company. It is being well-received by pilots.

are already helping the behavior of many of our older private ships.

Equally important to the improvement of flight characteristics is the need for a safe landing gear. The conventional undercarriage with the main wheels in front of the center of gravity is unstable. That is, if constant rudder or brake control is not used after a landing the plane will turn itself into a ground loop or ever tightening circle until it banks a wingtip or probably noses over. Even steerable tail wheels and other modifications only partially control this tendency and do not eliminate it.

A stable landing gear is one in which the main or non-swiveling wheels are behind the center of gravity. Such an undercarriage is the now well-known tricycle type which seems certain to have complete adoption. No control is needed for it to pursue a straight course. In fact, at the higher rolling speeds a large amount of control is needed to turn it and full application of one brake will cause no trouble. Furthermore, with the wheel in front it subordinates the possibility of nosing over almost to the vanishing point. Full brakes can be used to stop the roll and the ability to stop any vehicle suddenly is the most fundamental path to safety.

While this is not a feature that will stop the dangerous type of accident in which injuries and deaths occur, it does prevent the expensive type of accident where a plane can be almost totally demolished even though it had never left the ground. In our opinion, the ever-present possibility of having a large repair bill to pay as the penalty for a slight slip in ground handling technique on a conventional plane, is keeping more prospects from buying than the outright fear of injury. At least the tricycle landing gear makes it "safer" for the salesman.

Many of these simplifications and safety features have been sought in the past with freak designs. The tail-less ship has persisted almost from the start of flying. To evaluate its characteristics easily it should be thought of as an ordinary plane with two tails—one on each wing tip. The results are complex but indicate many distinct advantages, the principal one of which is possibly speed. There is good promise that they may be faster than the conventionl ship. The Waterman tail-less ship now flying has subordinated this feature to simplicity.

The tail-first airplane is laid out so that the front tail lifts and is made to stall before the main wing, thus nosing the ship down and preventing the main wing from attaining a stalled position. The tail usually "makes hash" of the air flowing over the main wing, decreasing the efficiency of the ship to a point where this type has never made good. Furthermore, once thrown well out of control, the problem of recovery is even worse.

Rotary wing aircraft are a long story. We once had a cartoon stuck over our desk of two little birds on a barn roof. They are watching an autogiro fly overhead. One of them remarks:

"Well, maybe we're wrong."

Frankly, we wonder if it is wise to put a vehicle into the hands of the average private owner that has as much energy stored up in it, even when standing at rest, as in a rotor. We have wondered about this ever since the day we watched a futile attempt to taxi a giro into a small hangar when the rotor was still turning. Splinters flew for miles around. Terrible accidents *could* happen, even without the craft moving.

Furthermore, when the helicopter gets here—as it will *very* soon—we will have the problem of killing the lift the instant the ship gets to the ground to prevent ballooning in cross-puffs. It can and will be done, but its introduction is not going to automatically solve our safety problems. It is merely going to eliminate our current headaches in exchange for a whole new set. Even that will be refreshing for most of us. Fundamentally it is the most promising attack we have.

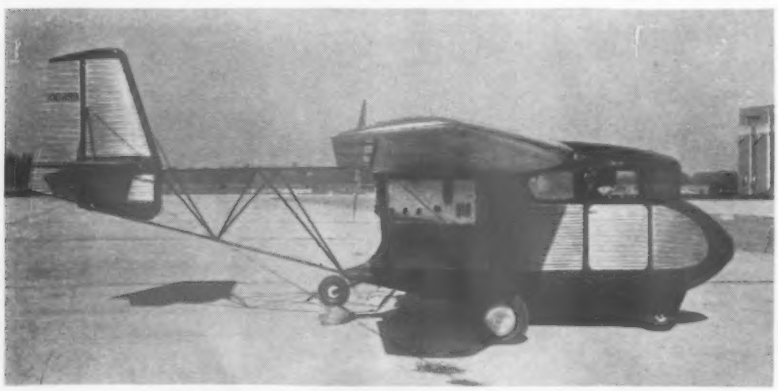
In order to judge the new crop of simplified planes it is well to look at the past. One of the first serious attempts in this country to produce a safe airplane was the *Tanager,* the Curtiss entry in the Guggenheim Safe Airplane Competition of 1929. It was a biplane with floating ailerons at the wing tips that could never be stalled, even though the wing had "let go". It was fully flapped and slotted and did some remarkable things. It won the competition even though many thought it had been outpointed by the Handley Page *Gugnunc.* It then made a tour of the country and very soon faded out of public consciousness along with the results of the competition. Few people know that it ended in a grand crackup "just like any other airplane". However, it did not spin in or stall but rolled over on the ground, the victim of its conventional landing gear and the energy that is present in any moving vehicle.

Shortly afterward Bill Stout built his little pusher *Sky Car.* It started with floating ailerons but soon returned to ordinary ones. It had its two main wheels directly under the center of gravity and rocked from a nose wheel to a tail-wheel as the pilot wished. It flew for years—up until just recently—and deserves a bigger name in the history of the development then it ever got.

In 1934 and 1935 Mr. Fred Weick, then of the N. A. C. A., built a little pusher somewhat resembling the *Sky Car.* It was called the W-1 and later with glide control flaps added to the wing, the W-1A. It was powered with a Pobjoy engine and used what has subsequently become the standard tricycle gear. It was flown extensively with varying degrees of dihedral and tail area as a three-control ship and as a two-control ship either with the rudders locked and ailerons used or with ailerons locked and rudders alone used. It also had a limited elevator and proved that it could continue in controlled flight even if the pilot did practically everything wrong.

The performance of the plane so enthused Mr. Eugene Vidal then Chief of the Bureau of Air Commerce that he asked for bids on airplanes with unusual safety and vision requirements. The winner was the Stearman-Hammond and the winning of the award was probably the most unfortunate thing that could have befallen that company, first because the specifications had been so severe that

(*Continued on page* 78)



This is the famed Stout "Sky Car" of about nine years ago. It embodied many safety features which since have been "discovered" and included on some present-day designs.

HAMPDEN TAKES ITS BOW

One of Britain's most formidable long-range bombers is this Handley Page design now in production.

JOHN BULL needs heavy, long-range bombers and knows it well enough to be doing something about it. Among the several excellent types in this category of the Royal Air Force is the Handley Page *Hampden* shown on this page. The excellent photographs of this ship show off a few of its unusual features. In the upper picture can be seen the *Hampden's* fine outlook for its pilot and bombardier. In the lower view can be seen the deep bulge at the bottom rear of the fuselage where a machine gun "nest" protects the ship's tail. The two engines are 1,000 h.p. Bristols. According to figures from a British correspondent, the *Hampden* has a cruising speed of 212 m.p.h. and, at that speed, has a range of 1,725 miles carrying a service load of 3,587 lbs. This ship also is equipped with slots and flaps.

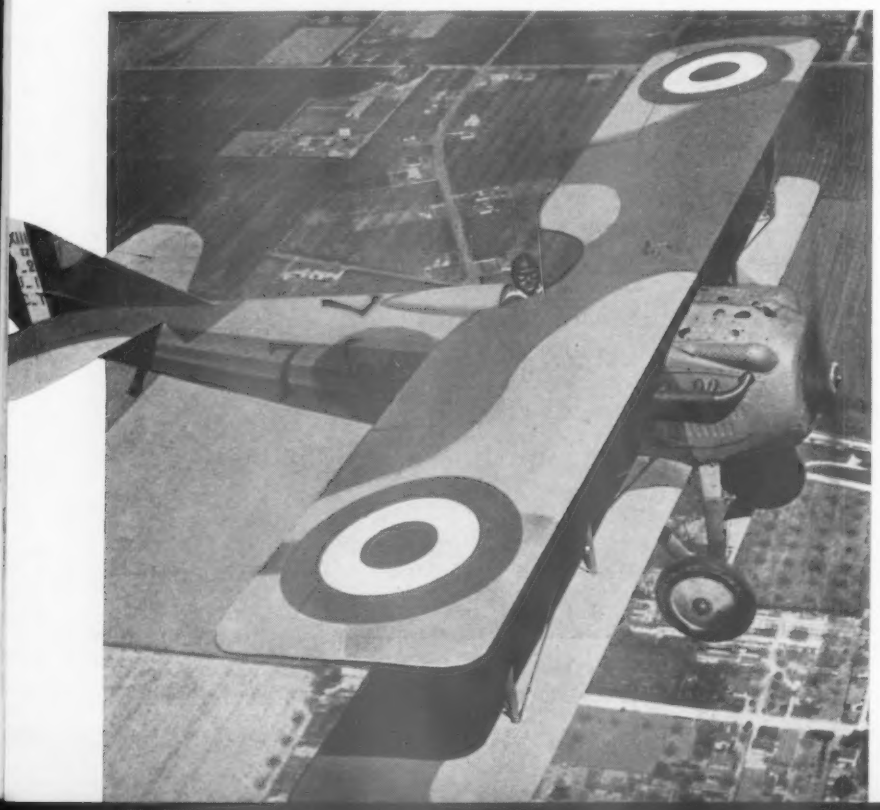
This is a "Hampden" as seen from the bombardier's position in the nose of another identical ship. The picture at the top of the page shows a "Hampden" taking off.

IT'S NOT ALL HOKUM!

That Hollywood does take pains in getting its aviation films accurate is evidenced by this scene from "Test Pilot." Bombers and attack planes were loaned by the Army.

★ ★ ★

One studio spent a fortune rebuilding authentic wartime planes for a movie. This is a rebuilt Spad, complete in every detail. The pilot is Paul Mantz, famed movie ace.



THE power-dive is over. The Boeing P-12 has brushed its wheels along the ground at Metropolitan Airport, out west of Van Nuys in the San Fernando Valley, and the helmeted man at the stick is lifting her nose skyward. The pilot, Frank Clarke, starts going into the favorite maneuver of his friend, Paul Mantz—a lazy, climbing slow roll. By the time he has rolled onto his back a vague premonition has gripped 50 groundlings—an assistant director or business managers, mechanics, pilots and camera and sound crews.

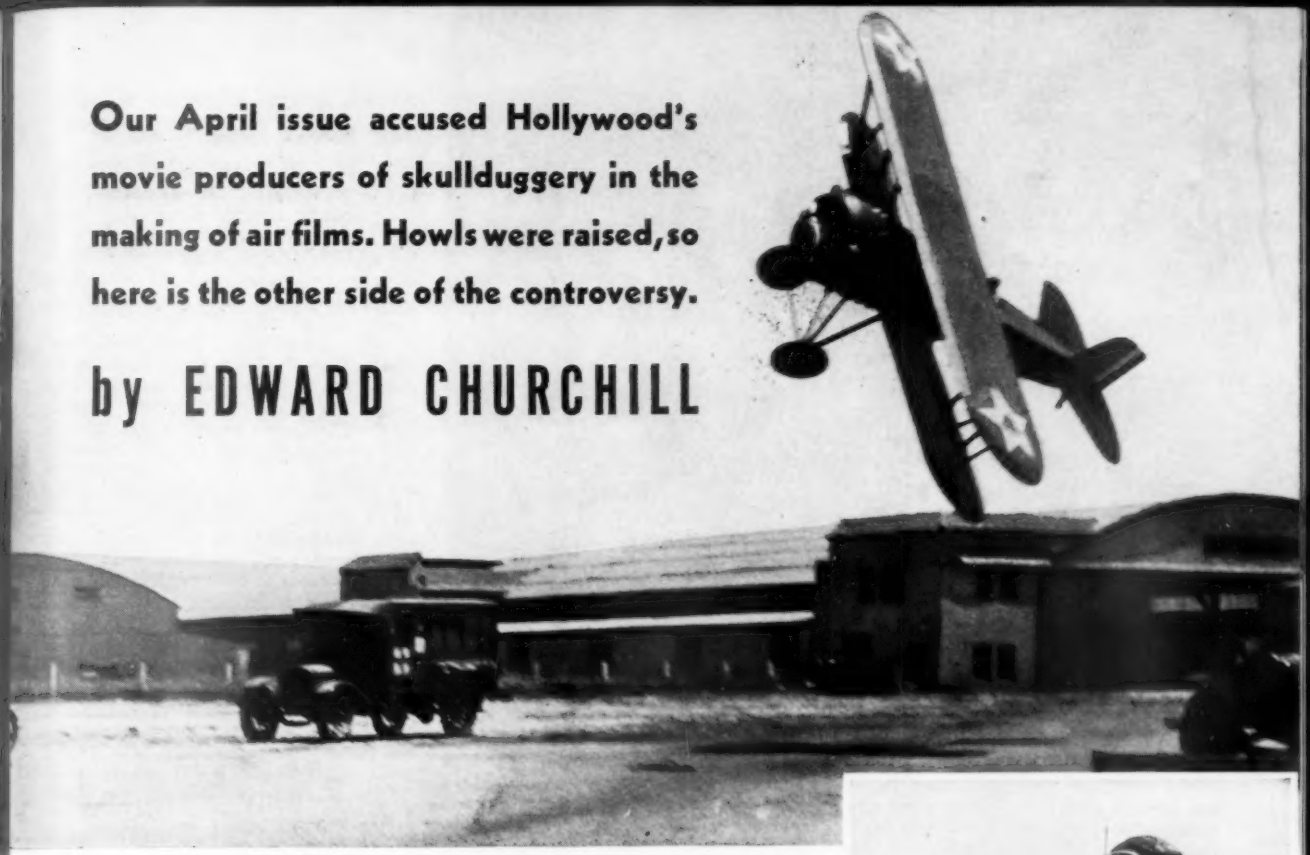
All stare at the plane as it starts to fall off into a spin 200 feet up. Clarke seems to be pulling the stick back into his belly. The plane wavers for a moment, the nose drops. Clarke is starting into the last half of a loop. Upside down, he's coming inside—and he's coming fast. The groundlings stand still, stare, waiting for a final roar, impact and then fatal silence.

The prop bites great hunks of air. The ship comes in faster and faster. It looks as if Clarke hasn't a chance to level. Then he begins to make it. It's an even chance whether he'll go on in or whether he'll get level before he hits. Then, as the motor roars to a peak, plane meets ground. There is a kind of "blup" as the tires hit, flatten and the undercarriage splays. The ship bounces into the air with the tail skid digging a furrow.

Safe! But the groundlings gasp. For the P-12 is barging straight at a row of hangars 30 feet high. The motor is lungy.

Our April issue accused Hollywood's movie producers of skullduggery in the making of air films. Howls were raised, so here is the other side of the controversy.

by EDWARD CHURCHILL



The veteran Frank Clarke was flying the "doctored" Boeing P-12 in the above picture. This is an actual photograph of authentic flying necessary for a recent air picture.

This looks like a second set of curtains in as many seconds. But no! Clarke tinkers with his stick, spaced between crashing the hangars and stalling. He clears the rim of one by three feet. You can hear the air whooshing out of 50 pairs of lungs.

Nobody says anything for a minute.

In fact, it's some time later, and Paul Mantz, head man in the motion picture-airplane industry, whose frequent effort brings forth our air pictures, is in his airplane-decorated den.

"In the first place," Mantz is saying, "if it hadn't been Clarke there'd have been a corpse. In the second, that's just one of the daily proofs that all is not hokum in Hollywood!"

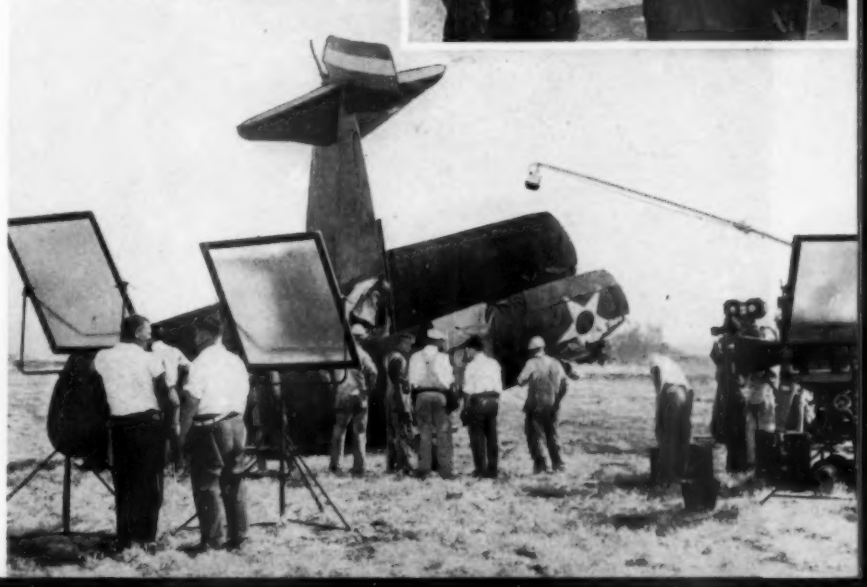
Mantz should know. Starting in 1931 with one airplane, he has flown in, has been technical advisor on, such pictures as "Air Mail," "Men With Wings" and now "Only Angels Have Wings," to mention a few of the tops. Add to that list "Test Pilot," "Night Flight" and about 20 others, and you have some idea of what Mantz has been doing for a living.

"Hollywood does the best it can with what it has in materials and men," Mantz told me. "It has problems. One is financial. Another is a personnel problem. Still another is technical and concerns cameras. A fourth has to do with actors.

"It may surprise you to know that, dollar for dollar, aviation pictures are the most expensive to make—the most uncertain because of both weather and camera problems—and the slowest to film because of the odd handicaps which rise suddenly in production."

Mantz has very nearly broken his neck several times. He has flown through hangars, bounced ships off the ground and hangar roofs, crashed them, spun everything from tiny single-place jobs to Ford tri-motors and has flown every-

Al Lary (left) and Jerry Andrews are two of Hollywood's band of daredevil pilots.



This ship actually was crashed. The star then climbed in and posed for close-ups.

This close-up is faked. But Star MacMurray is sitting in an authentic war Spad.

thing from 1910 pushers to the fastest modern multi-motored equipment. He has pushed ships around eight and nine hours a day because the clouds were right, stunting most of the time. He has alternately frozen, fried and wind-blasted himself. Not neglecting the mental side, he has built up a $5,000 library of technical information on every phase of flying. That's why, two days out of every three in the year he is putting airplanes on film, and why the back of his head has been photographed more than that of any other man in motion picture history. (You thought it was Fred MacMurray all the time!)

"The problem of materials is the toughest," Mantz says. "First of all, you have to have equipment. And, if you're making a picture which isn't strictly up-to-the-minute and isn't laid right in the United States, your troubles begin. Consider 'Men With Wings,' a historical picture, and 'Only Angels Have Wings' which is laid in Central America. 'Men With Wings' was a problem in material for many reasons.

"First of all, there had to be the plane which burned after it crashed early in the picture. There was research and then the plane was built. It had to have a double in case the first crash went wrong. That cost $5,000. Then, for war scenes, there were 1918 planes to dig up, rebuild and repair. Today the studio which made that picture has 15 airplanes on its hands, six flyable. The list includes DH's, Monosoupape-Nieuport, Fokker, Hispano-Suiza Spad, non-flying Nieuports, SE-5's. They are in a hangar at Metropolitan Airport, under the care of a skilled mechanic. It cost the studio $30,000 to condition them, more money to test-fly them."

Mantz tested all of them himself before he would permit other pilots to fly them. He found they were all right, then turned them over to Richard Rinaldi, Earl "Chubby" Gordon, Frank Clarke and other pilots who put them through their paces.

Later one ship quit cold twice in the air. Another ground-looped when a former war pilot landed too fast. During the picture, more thousands were spent in flying them at $100 per day per ship, gassing and maintaining them. Also in the picture were several J-4 Travelairs, Stearmans, J-5 Travelairs, a 1910 pusher which "hit the cutting room floor," a reconditioned Buhl *Bull Pup* re-designed to look like a 1914 creation, a couple of Boeing P-12's, some OX-5 jobs used on the ground as "atmosphere," the Boeing 247D, JN4D's and the Lockheed *Vega* which MacMurray "dunked" in Long Island Sound.

"Those ships cost hundreds of dollars a day," Mantz says. "What's more, I haven't mentioned a Savoia-Marchetti which we had to ferry down from Washington state, a Ryan which went onto its back being ferried up from Imperial Valley and another Ryan which posed as *The Spirit of St. Louis.* First we had to locate most of these planes, taking them in any kind of condition we found them, rebuild them in most cases and then hire pilots to fly them. One ship we found in the basement of a hotel at Imperial, California, another we found in Arizona, and chased the owner half around the world by cable before we got permission to use it. We actually started flying on this picture in January and finished in August—seven months. The average, ordinary feature picture is 'shot' in 30 days, no more, no less."

Mantz, now working on the Central American picture, had to locate ships from Alaska to South America and have them flown in.

"When you get a picture which is off the beaten path, you have to reach for equipment," he explains. "With a Central American background we had to have Fords and Fokkers. There aren't many flying, and fewer available, in this country. So we sent for them."

For this picture—soon to be released—Mantz located a Fokker. It cost $5,000. He had it mounted on a ramp and the director sent it down the ramp, crashing and flaming to its doom—so many thousands gone up in smoke for a thrill in a very few seconds.

"When a producer really wants to put

Director William Wellman (left), a stickler for accuracy, confers with Frank Clarke.

This is a process shot, although all airplanes used were real and were flyable.

on a show, like 'Wings of the Navy,' and can show the authorities that he's not maligning the service or not preaching pacifism, he can get the use of Governing equipment and cooperation," Mantz says. "That's swell. But the script has to fit Government specifications. Government cooperation was refused on a recent picture, which was one of the reasons it didn't measure up to expectations—and why it cost so much more than had been expected."

The Central American picture, "Only Angels Have Wings," has been in production since January. Bad weather and a crack-up in Utah, lack of clouds over Southern California—clouds are necessary both for beauty and to give the audience a sense of speed—have been some of the factors which have held up production. Mantz is still working on this job.

"We're apt to leave for Florida at any minute," he says. And this isn't idle talk. The call may come at 5 a. m. and Mantz will be off at 7 a. m. in the old Boeing biplane, the Ford or his Lockheed camera ship. He spent three weeks in Pensacola on "Wings of the Navy," a week at San Diego, and went to Cleveland for "Tailspin." Travel is another expense on the budget—often unexpected.

Now to personnel. "Every technical man who sees a picture finds fault," Mantz says. "Make a picture of the oil industry and oil men beef. Do a newspaper picture and you get howls from reporters. Do a mining story and miners complain that this and that is wrong. First of all, to make a flying picture you have to have good flyers. Good flyers are getting scarcer and scarcer in Hollywood. Why? They get $100 a day—but only some days, and not often enough. Except when formation flights are called for in scripts, five men can handle all of the flying done for pictures—and have enough time to write a book on the side.

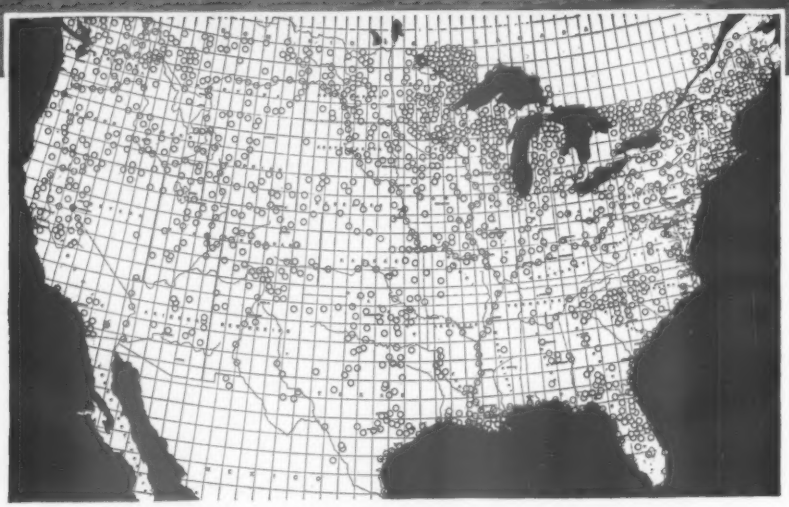
"The war crop, a great bunch of formation flyers, has gone. They are the boys who made 'Hell's Angels' and 'Wings.' Dick Grace has retired to write, "Doc" Whitney dispatches airliners, others have been killed or have died or have found better-paying, cash-on-the-line-every-Saturday-night jobs. Of the pilots who remain, many have other work. One fellow has mining interests; another runs an airplane sales and service business; another is employed in a studio transportation department when flying times are slack; another is a property man in a studio. On a sudden call, I would have a hard time getting camera-wise pilots for a flight of eight ships."

So much for the flying end—which points the moral that aiming at a Hollywood flying career isn't what it should

(*Continued on page 66*)

One studio went to enormous expense to rebuild in detail the above Navy bomber.

This is the scene in which one studio was criticized for its inaccurate crack-up.



The above map was prepared by the Consolidated Aircraft Corporation in cooperation with the Federal Government. Each circle indicates water facilities capable of caring for large passenger-carrying flying boats. It can readily be seen that transcontinental routes are feasible. In winter the southern, ice-free route would be used.

As airliners get larger, airports grow smaller. Instead of spending unlimited millions on enlarging present-day fields, the airlines might well consider using the limitless water facilities of the nation.

by

EUGENE P. LYLE III

THE scene opens a few years in the future. Perhaps five years from today; not over 10 at the most.

Several big trans-Pacific airboats are moored at the public ramps and floats at Treasure Island. This is a man-made island in San Francisco Bay, built for the 1939 exposition, and afterwards developed as an airboat terminal. Next to the Pacific clippers is berthed a little airboat belonging to the Southern Express. This latter is barely larger than the Boeing "314" of 1939.

Its freight has been stowed, its crew of eight and its 90-odd passengers are aboard. The hatches have been sealed and the six motors are idling. The clearance call comes from the control tower. Six propellers beat the air to a din, but to the passengers inside the airtight, insulated hull, the sound is only a muffled hum. They feel a slight vibration, and glancing out the double-glass windows, see the shoreline spin around in dizzy circles as the pilot warms the engines by taxying. Then the ship straightens out, heads down the bay a way, and swings round into the wind for the take-off. The ship takes the air, and the hum of the motors quiets to a steady purr. The airboat rises over the Golden Gate Bridge, then dips its port wing and heads south, following the broken coast line.

First stop is San Pedro Harbor, on the outskirts of Los Angeles. Here additional passengers come aboard and the plane takes off again, heading eastward across the continent. It wings over the Salton Sea, over Parker Lake on the Colorado River, to Roosevelt Reservoir in Arizona. Some passengers stop over at the resort while others are shuttled to Phoenix and Tucson by "tiny" 30-passenger amphibians or by bus.

Coolidge Lake in Arizona and Elephant Butte reservoir in New Mexico can be seen on the next leg of the trip, which ends with a landing on an artificial lake on the outskirts of El Paso, Texas. This is a lake created especially for cross-country airboats, fed by the Rio Grande and developed into an attractive civic park. A half hour before the plane's ar-

ARE FLYING BOATS THE ANSWER?

rival sirens warned bathers and canoers out of the water. An airport speedboat brought in laggers 15 minutes before arrival.

From El Paso the flight continues to Lake Worth on the outskirts of Fort Worth. From here amphibians shuttle passengers to Lake Brownwood at Brownwood, Texas, to Whiterock Reservoir at Dallas, to Galveston on the Gulf and about any place else within a 500-mile radius where passengers and freight offers. At Fort Worth fuel is pumped into the wing tanks—sufficient to carry the plane over 2,500 miles, so that even in bad weather it has plenty of reserve range to reach waterways far off its regular course.

The next hop ends at McAlester Lake at Little Rock, Ark. More passengers disembark to be whisked by amphibian to Cross Lake at Shreveport, La., to New Orleans, to Memphis on the Mississippi River. Then the express continues on to Nashville's Skyport Lake, fed by the Cumberland River, especially created as was the lake at El Paso.

Winston-Salem, N. C., comes next, where a lake has been created by damming the Yadkin River. Very soon now the ship is working its way into the thickly populated eastern seaboard where the waterways are almost within gliding distance of one another. A landing is made on the Potomac River at Washington, D. C., and feeder lines branch out in all directions. Then one more short hop for the express, a neat landing on New York's Upper Bay, a quick taxi to the Midtown Skyport, and the cross-continental journay is over. At New York the really large trans-Atlantic clippers await European-bound passengers and express.

. . . . . .

Now we're back in 1939 again. We still regard the Boeing "314" and the DC-4 as large planes. Has this prophecy of a trans-continental airboat service sounded fantastic? It was not intended to. Some of the most conservative engineers in the world today are thinking along those lines.

Present-day cross-country commercial flight is faced with a serious problem, that of building fields large enough to accommodate projected giant landplanes.

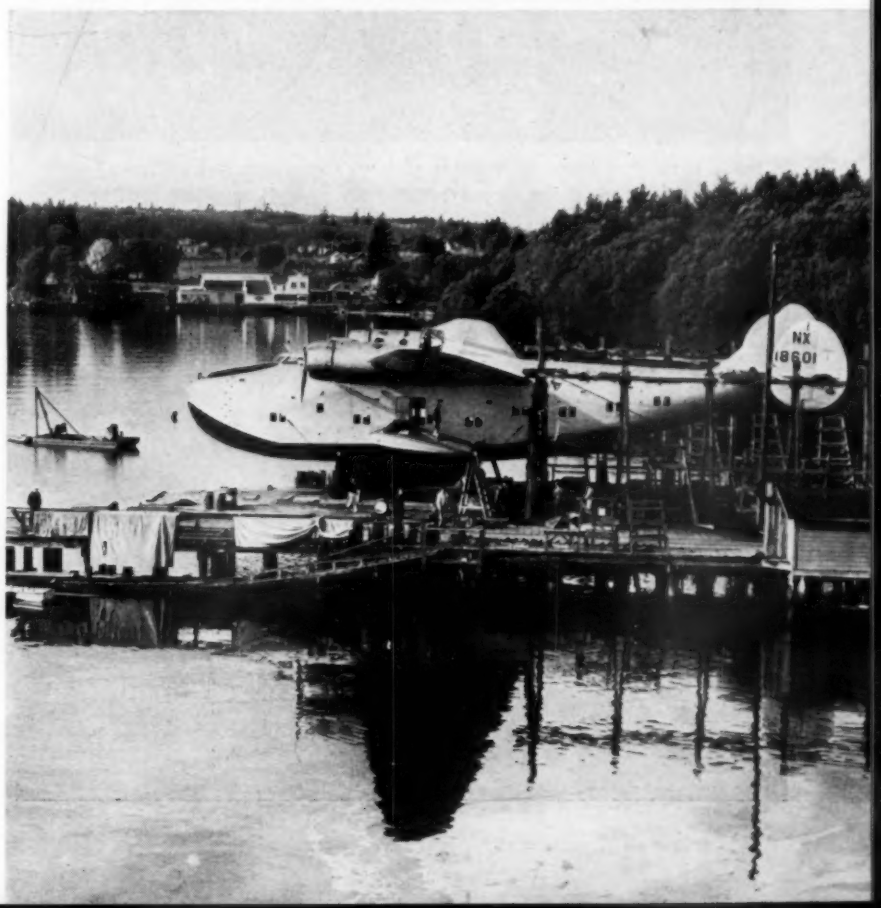
Quizzed by Los Angeles reporters, Jack Frye, president of TWA, made this statement the other day:

"Los Angeles must build up its municipal airport if it wishes to continue to rank as a Class A-1-A city among major American air centers . . . Expenditure of $8,000,000 there would give the city a field comparable to New York's $37,000,000 North Beach port now being completed."

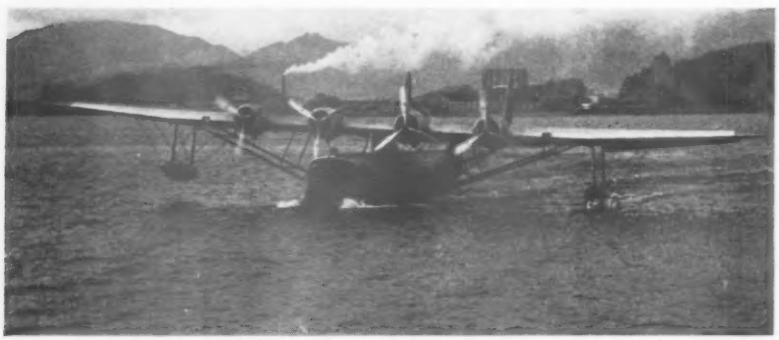
Mr. Frye might have included most of the terminals and intermediate fields in the United States in the inadequate class. There are only about four which are thoroughly suitable from the pilot's point-of-view.

Eight million dollars is a lot of money to spend improving an already costly field. Thirty-seven million dollars, the total cost of the New York terminal, would buy a right fancy railroad station. And airplanes do not have the traffic

Giant boats like Pan America's transatlantic clippers might well be used for the longer transcontinental airlines. Shortest coast-to-coast route is 2,587 miles.

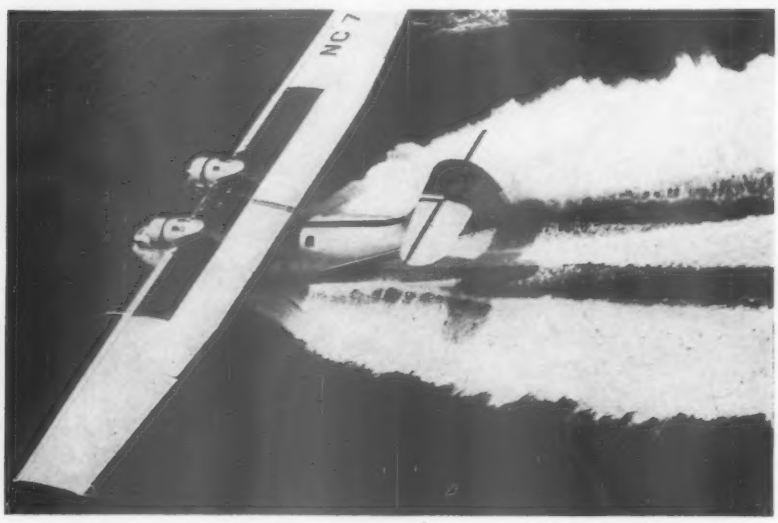


Richard Archbold has spanned the continent five times in his first and second Consolidated flying boats ('Guba II' above). Such flights are as safe as with landplanes.



Flying boats have access to hundreds of lakes, rivers, bays and harbors. Practically every major city in the U. S. has some water facilities adaptable to these ships.

With large ships water take-offs are, by comparison, much safer than with landplanes in case of engine failure. The boat pilot simply lets his craft settle onto the water.



railroads have. Then, too, in many cases there is no more land available for enlarging existing fields, and growing cities are crowding them. New routes will be opened to accommodate future demands. Will these routes be as castly to build and maintain as existing ones? Probably more so.

So—the demand for a solution to the airport problem is opening a brand new field to pioneering—that of using airboats for cross-country work. Most of the pioneering along this line so far has been incidental to other objects. The Navy and Coast Guard have made practical demonstrations in coastal flying. Twice in 1938 Naval patrol-bombers spanned the continent non-stop. The object was to demonstrate that such big airboats could be based on either coast and be transferred quickly to the other coast. Richard Archbold, noted explorer, has five times spanned the continent in his PBY airboats. Three of these trips were non-stop. At present Archbold's ship, the *Guba,* makes almost daily flights from Hollandia on the coast of New Guinea Netherlands to Lake Habemma, 12,000 feet high in the deep interior of the island. These flights transport food and scientists and native workers over jungles and mountains to camps that would be impossible to reach by any other means.

Such feats, routine to the men who perform them, demonstrate the practicality of using airboats on commercial overland routes. Commercial interests are just beginning to investigate seriously the possibilities. It is known that Pan American has men busy at paper work on the problem, and that Consolidated Aircraft in San Diego is undertaking a considerable research. Rumors whisper that several other airlines and manufacturers are playing with the idea.

Airboats flying across the continent, at first thought, sounds as dangerous as landplanes flying the Atlantic. But it isn't, really. Glance at the map. There are thousands of lakes, rivers and harbors in the United States suitable for the heaviest airboat to take off from. Many rivers and lakes form continuous landing areas for hundreds of miles. Besides these, there are thousands of other bodies of water, smaller, though quite large enough for emergency landings. An airboat can land in about half the distance a landplane requires because of the braking effect of the water. By making a slightly zigzag course across a southern route, for instance, the average distance between water is 60 miles. No distance is greater than a hundred miles.

But what would happen if an airboat had to make a forced landing where there was no water? That's a good question, and there's a good answer to it, because it has already happened a number of times. A few years ago a passenger disembarking from one of Pan American's Consolidated *Commodores* stood on the landing float looking at the ship.

"You know," he said to the pilot, "I was in a plane just like this the other

(*Continued on page* 70)

"SHORTY"

by KURT RAND

He is crazy on the subject of air safety; crazy in an invaluable sort of a way. Which, for a guy who plays the accordion for a hobby, is something worth discussing.

Major R. W. "Shorty" Schroeder.

IF you knew all about the history of American aviation and were told to pick out the individual who has contributed the most to its development, the man you would choose in all probability would be a tall gangling person with a shock of white hair above a hatchet face, tanned and weather-beaten by thousands of hours of flying in open-cockpit airplanes. And you would find this individual today in a neat office within United Air Lines' modernistic executive building just across Cicero avenue from the Chicago Municipal airport.

This man is Major Rudolph W. Schroeder. To everyone in aviation he's known affectionately as Shorty, although his height is 6 feet 4 inches and his weight something under 160 pounds. His accomplishments are so numerous that it will be impossible to list them all within the scope of this article, but it should suffice to say that Shorty is the only man active in flying today who has spanned the 29 years of aviation's history from the barnstorming days of 1909 to the modern deep-air radio range and instrument flying of today.

Those who know him best agree that the sum total of his work comes near to being the approximate total of aviation progress to date. Through most of the major developments in flying Shorty has had a guiding hand. It can truthfully be said that as far back as 1919 he had a conception of kind of flying that is being done today and that it was he who sowed the seeds that have produced the airplanes, engines, propellers, instruments and even the flying procedures that are followed today by the Army, the Navy, all the commercial airlines and many private flyers.

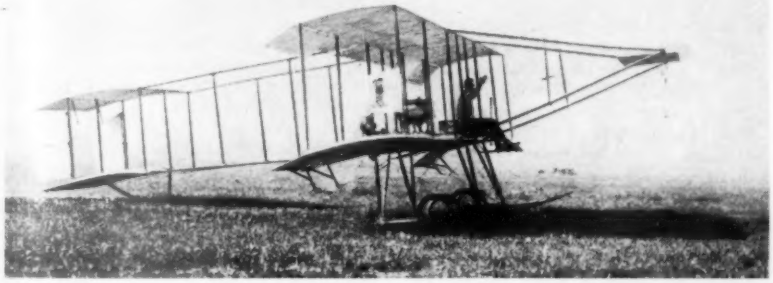
Throughout all Shorty's history his chief interest has been in "the man". Shorty's concepts have always been that the dangers in aviation were inherent in "the man" as opposed to the machine. Most of his sowing has been done in the interest of helping "the man" and taking some burden off his shoulders, or in providing him with an "out" in case of a mechanical failure. Today Shorty still is working with "the man"—in this case the pilot personnel of United Air Lines. He's vice president in charge of safety.

Speaking of flying in general and not particularizing in reference to his own or any other air transportation company, Shorty says that too much is being required of the pilots. And the air transportation industry leans to far too great a degree upon the stalwart shoulders of the men who, as he says, "are flyin' 'em." The pilots' requirements today are those of supermen. Soon they will have to be more lenient because there has been no crop of supermen along in several centuries.

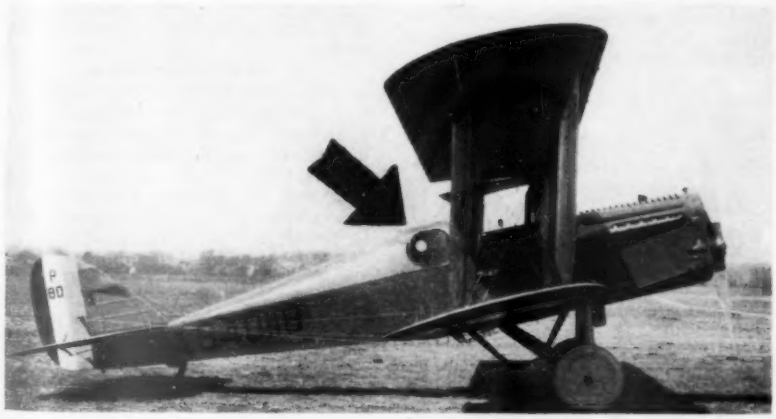
The next great step in aviation, Shorty says, will be the perfection of airplanes, engines, instruments and procedures that will parallel to a great degree those of ocean vessels. Pilots instead of being jugglers who must make landings that are in the nature of balancing stunts and must fly on instruments using procedures that require constant practice and the utmost in clear thinking and precise and carefully timed action, will become merely engineers.

Devices must be perfected, he believes, that will literally fly the plane through every maneuver—take-off and landing included. Other devices must take care of the navigation. The pilots will merely go along to observe the functioning of these devices and to take over manual control of the ship only in case they fail to function properly. When that day comes pilots will not be considered the primary and all-important cog in the transportation picture—and the industry will have arrived.

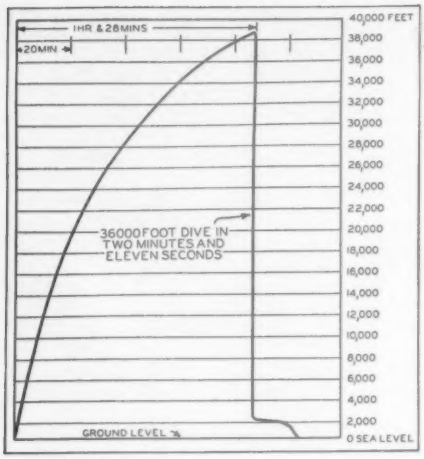
Don't get the idea that Shorty dislikes



The famous Brodie Farman was Shorty Schroeder's pride and joy, although he was little more than the ship's mechanic. Many of his "safe" ideas were formed during these days.



In case you think supercharged cabins for altitude flying are new, we offer this picture. This DeHavilland was so equipped in 1920 for Schroeder's altitude tests.



This chart, made directly from the barograph in Schroeder's plane, shows his terrific dive.

pilots. He's notoriously biased in favor of the pilots because he has been one himself since 1910. He merely believes that there is a limit to the capacity of human beings and says he thinks the requirements of airline and military flying today are appdoaching these limits. That is why he wants the requirements changed. The pilots themselves know his beliefs are well founded and most of them agree in every particular with Shorty's thinking.

All this from an aviation newcomer, or one who had a background less rounded than Shorty's would be considered merely hot air. But consider this partial list of Shorty's achievements. He was the man who:

1. First developed electric landing lights for night-flying airplanes and electric ground lights to illuminate a landing field for an incoming plane at night.

2. Started the Army Air Corps upon its development of the modern parachute.

3. Started the development of the controllable pitch propeller—itself one of the greatest developments of the era. Shorty still gets a royalty for an essential gadget still used in certain of the modern constant speed controllable pitch propellers.

4. Determined the need for and started the fuel company laboratories upon the hunt for high-octane gasolines. Ethyl fuels of today were uncovered as a result of Shorty's statement of the need for better grades of fuel.

5. Conducted the first experiments with the turbo-supercharger that is, apparently, the gateway to operation of modern aircraft engines in the sub-stratosphere.

6. First penetrated into the sub-stratosphere in a flight of a heavier than air machine.

7. Was largely responsible for the design of the famous Ford tri-motored airliners. They were designed as the first American commercial airplanes with more than one engine. Shorty demanded more than one motor as a safety precaution.

8. Operated the first freight-carrying airline in commercial operation.

9. Established the "twin" theory that now is the measuring-stick for modern air transportation operations the world around. This theory calls for at least two of every essential unit in an airplane—motors, instruments, pilots, radio, etc., so that safe flight can be continued in case of the failure of one of these elements.

10. Established the first set of safety rules to be observed by pilots flying for an air transportation company. Procedure manuals to cover all or almost all the situations in which a pilot can find himself today are one of the chief reasons for the current safety record of the commercial airlines.

Today Shorty is one of the moving figures behind a plan to establish 10 or 12 radio direction finding stations at key points throughout the United States. Three or more of these stations would be more able to take simultaneous radio bearings upon any airplane in flight that had a radio transmitter. These simultaneous bearings would be taken within a few seconds and transmitted to a central station where triangulation of the bearings would determine the position of the airplane.

Shorty says that once this system has been established there will be no chance of a pilot becoming lost so long as his radio functions. The bearings could be taken every ten minutes if needed and the track of the plane followed faithfully from the ground in this manner. The ground would tell the pilot which way he was headed—the track of the plane—and instructions from the ground crews would be relayed to the pilots to tell how to go to their proper destinations.

Visionary? Jules Verne-ish? Not at all. It's just that Shorty, as usual, is ahead of his time. He's seen so much and come so far in aviation that he no longer minds a bit of laughter from the rest of the world that lags behind. He's the mildest of men and a soft touch for aviation's many hoboes, because of his vast placidity and tolerance. He can spin you tales that date back to the days when Wilbur and Orville Wright still were names to conjur with.

Shorty worked with lots of early barnstormers including Mickey McGuire, Otto Brodie, Walter Brookins, Lincoln Beachey and Katherine Stinson. In 1916 he enlisted in the Army signal corps—aviation section. In two years he rose from an enlisted man to the rank of major and the post of chief test pilot for the army experimental center at Dayton, O., now Wright Field.

Starting as enlisted pilot he was commissioned first lieutenant and given charge of flight training. Then he was made a captain and took over the night flying school at Ellington field, Texas. In those days of frequent deaths among flying students, Shorty proudly recalls, there was only one fatality in the period he ran the night flying classes. It was at this school that he did his work on landing lights and ground lights.

Then they called him to Dayton as chief test pilot. As he says: "I didn't like this too well because the men who had preceded me had both been killed in crashes of experimental planes. I was no hero. I wanted an out. I asked for a parachute."

The British Guardian Angel that tied to the outside of the plane beneath the cockpit was the only kind then available. When the pilot jumped a rope tied to his harness pulled the parachute out of its case. This was true providing the pilot jumped out the proper side of the plane and provided there was no wing failure to fold back and prevent the parachute from clearing the airplane.

Shorty saw these dangers and demanded a parachute in a knapsack so he could carry it on his back. Then, when he jumped, he would wait until he was clear of the plane before pulling the rip-cord.

"That's when they got busy on parachutes," says Shorty, "and the very first 'chute turned out by good old Floyd Smith who did most of the earliest work —was mine."

As soon as Shorty arrived at Dayton he began high-flying experiments. It was in these flights that he worked out the use of oxygen to assist the pilot in the thin, smothering air of great heights. He had been there only a short time when he set a world's record of 31,000 feet. That was in the spring of 1919.

The need for supercharging was clearly understood and the Army was experimenting with an exhaust driven supercharger developed by Dr. Sanford A. Moss. In this supercharger there was a turbine that operated the compressor. Exhaust gases from the motor were used to drive the turbine at speeds up to 22,000 r.p.m.

Finally the first of these superchargers was installed on a Liberty motor—400 h.p.—in a Lepere biplane. In August, 1919, Shorty took the Lepere up to 18,400 feet with a passenger, Lieut. G. W. Elsey, as observer. The engine developed such power that connecting rods were blown through the crankcase, effectively halting that flight.

Corrections were made and, in later flights, they found that the supercharger worked well. The engine developed its full sea-level power up to approximately 18,000 feet and the indicated airspeed at that height, when corrected for pressure and temperature, worked out at 137 m.p.h. This was *much* faster than the plane could fly at sea level and Shorty's theory that high speeds could easily be developed in the thinner deep air was proved.

Out of this experiment came Shorty's recognition of the need for controllable-pitch propellers. The wooden fixed-pitch propeller on his plane tended to turn faster than the limits of the crankshaft speed fixed by the motor manufacturers. A propeller able to take a bigger "bite" at high altitude was needed, so Shorty started off the experiments that are seen today in the Hamilton-Standard and Curtiss constant-speed propellers.

The Moss supercharger worked so well, in fact, that Shorty began thinking about flying up to 40,000 feet. When all was prepared he made his first try for 40,000 feet and the sub-stratosphere on Feb. 6, 1920. Although much has been

(Continued on page 68)

STREAMLINED DEBUT

Latest lightplane is this pert Stinson "105". It sports a 75 h.p. engine, slots, flaps, seats for three.

The Case For 4 Engines

By JAMES BASSETT, Jr.

Having just been granted an airworthiness certificate by the Civil Aeronautics Authority as this is written, it now remains for the Douglas DC-4 to be bought by airlines. Note feathered propeller.

BEYOND a shadow of a doubt the burning question today before the airlines of America is: "What about four-engined transports?"

More than a year ago the mighty Douglas DC-4, weighing 65,000 pounds fully loaded and capable of hoisting 42 passengers aloft, began her rigid series of tests which at the time of this writing had not yet been completed. Somewhat later came the Boeing *Stratoliner*, lighter, smaller, but with a pressurized cabin for so-called substratosphere flight.

Five airlines cooperated in preliminary draftsmanship on the DC-4. Each tossed $100,000 into the kitty and to date the Douglas Aircraft Corporation itself has spent a cool $1,500,000 in addition to the airlines pool. Presumably the DC-4 is exactly what the transport companies want. So, too, is the Boeing. Pan American Airways and TWA ordered several *Stratoliners* on the spot. Currently the latter is indulging in litigation over certain phases of the contract. But eventually, it is firmly believed in airline circles, TWA will be flying Boeings.

What is the immediate future of these Big Berthas of the skylanes?

When will they be operating across the 2,600 miles of airways from the Pacific to the Atlantic?

Do the lines want them *now*—or next year? Or how soon?

If they don't desire these aerial behemoths today, why are they dallying?

Is there a need for four-engined equipment at this admitted crossroads period in air transportation?

To discover the answers to those problems, a questionnaire was dispatched to the three concerns that daily operates dozens of schedules between the two coasts: American Airlines, TWA and United Air Lines. This trio comprised three-fifths of the backers of the DC-4. They ought to know what the industry wants Nor were they hesitant in outlining present and future needs.

American—only transcontinental line to keep its ledger in the black in 1938—gave the fullest reply. Part of its answer already lay before the public in President C. R. Smith's stockholders' report:

"It is not anticipated that larger and more expensive aircraft will be in operation on the domestic lines during 1939. . . . There are many empty seats in the present aircraft which should be sold before larger aircraft are acquired. . . ."

Thus business loomed starkly as the major reason why four-engined machines probably will not roar over America's airlanes for at least a year. Drawling, Southern, hardheaded, C. R. put it this way: "If you're in the business of building bungholes you should endeavor to build those bungholes at a profit. For, if you did not operate at a profit, you would not be in the bunghole building business very long.

"The industry last year operated with a load factor in the neighborhood of 50 per cent. In 1939 this will probably be improved. All of the airlines, however, plan additional schedules and it may be that unless business increases quite materially we will carry a greater number of passengers but will not operate at a load factor much higher than last year."

Load factor again means strictly business. Airliners cost plenty to fly. The old DC-2 scampered along at about 65 cents per mile. With the advent of the DC-3, carrying one-third more passengers and considerably more cargo, the per seat-mile cost dropped. So up hopped economy. But the DC-4 was something else. Apparently savings won't be great—if any—with this four-engined craft.

And the investment! "The present DC-3's," continues President Smith, "cost about $110,000 each. . . . The DC-4, for instance, will be able to transport on most flights fairly close to double the number of passengers carried on the DC-3, but it looks like the capital investment is going to be $400,000 or $500,000. So we wind up with a materially increased capital investment per seat which will have the effect of increasing the cost of operation per seat mile, unless other factors bring it down. . . ."

Hopped up to 220 m.p.h., the DC-4's speed may help slash running expenses.

Safety? As an old two-engined transport addict, Smith views the DC-3, with its brand-new full-feathering propellers as "comparing favorably with any four-engined airplane".

Right now it appears that the airlines hanker for a breathing spell. A chance to make a few honest dollars with present, perfectly satisfactory, equipment. Here's Smith's summary:

"We believe quite thoroughly that more modern and efficient airplanes will be built and operated and we do not take the position that DC-3's will be the only type of airplanes operated in the next four or five years. We *do* say that we should wait to buy larger aircraft until we need them—and until our balance sheet and passenger business reflect an ability to pay for them and operate them at a profit."

The biggest equipment problem the airlines face today centers around the giant four-engined airliners soon to be available. Can these expensive monsters pay their way on the nation's lines today?

Boeing's big "Stratoliner" vies with the DC-4 for the honor of being the first of the new giants flying the airways. Unlike the unordered Douglas, the Boeing already has customers awaiting delivery.

Vice-President Harold Crary of United sets 1941 as the earliest date such a machine as the DC-4 would be serving America's air travellers. This is how they'll be used:

"Obviously, four-engined equipment can only be flown on trunk lines which would have planes operating between division points on coast-to-coast service to feed in mail, passengers and express. It is certain that the ships should not be operated coast-to-coast with less than two stops, and probably three, because airlines cannot make money carrying gasoline instead of payload.

"The airlines have demonstrated that frequency of schedule is an important factor in the development of air travel."

Crary's right. The much-travelled New York-Chicago run finds 27 schedules daily shuttling back and forth. That's better than a plane-an-hour. The railroads can't match that for convenience.

Still another problem exists, Harold opines.

"Under their airmail contracts, the airlines must provide service of stipulated frequency to small and intermediate cities. For instance, United, on its New York-California route, has 20 stops to take care of on five schedules—putting some towns on one schedule and some on others—and the flying of a 42-passenger ship would mean that beneath it on a three- to eight-stop flight across the country would wing additional DC-3's. In some cases even smaller aircraft would operate because of field conditions at intermediate points. . . ."

Yet, Crary adds, there is a favorable side to the four-engined ship's prospects:

"It is probable that by 1941 the number of people who will have accepted air transportation will have increased to a point warranting the use of these larger planes on key routes. . . . As you probably know, there is agitation for a three-cent half-ounce airmail letter to supplement the present six-cent one-ounce airmail letter. Should that or other new airmail promotions occur and the coast-to-coast and long distance airmail increase appreciably, the utility of four-engined equipment would be emphasized."

This is United's own summary of the case for the Big Berthas:

"A major problem of the air transport companies in appraising four-engined equipment is the economic factors which involve such items as the anticipated increase in mail, passengers and express during the five-year period the ship would be in service (starting 1941), the policy of the Federal government in dealing with airmail operators, rate of pay, competitive angle between airlines, etc. . . ."

From TWA, torn between the Boeing *Stratoliner* and the Douglas DC-4, came the most urgent plea for four-engined equipment. For months this line has blown first hot, then cold on both ships. At this moment the Lindbergh Linemen appear to favor the Douglas. Yet they still want a machine to probe the so-called "substratosphere".

Says a TWA spokesman:

"A large plane, flying at high altitudes and increasing our winter operations efficiency 35 per cent so that we would be operating at about 95 per cent efficiency would undoubtedly bring us more passengers, would not only increase our individual loads but would encourage other persons to fly."

Naturally no aircraft today has a monopoly on the upper skies. With some juggling, and the addition of a pressurized cabin, the DC-4 could be converted into a transport capable of comfortable, sustained flight at 20,000 feet. One airline executive told me he knew this could be done with less than 1,000 pounds additional weight—a worthwhile sacrifice.

Money permitting, the airlines might desire these machines at once. But money—and other factors—apparently do not permit. Yet TWA says:

"We would want four-engined ships probably for our fall operations. . . . We want a plane that has plenty of power so that it can fly weather which we cannot fly at present, a ship that has a greater safety factor insofar as range is concerned."

Such is the forum on the multi-motored sky giants. Likeliest prospect for the four-engined builders seems to be such a line as Eastern, another of the contributors to the DC-4 kitty. Flying over much-travelled medium-distance routes, it could make splendid use of a sky Pullman like the Douglas. Even the transcontinental lines view the New York-Chicago run as the logical starting point for the Big Berthas. In the Far West, United has its lucrative Los Angeles-San Francisco haul over which the DC-4 could operate profitably. Also it is significant to note that United, whose President W. A. Patterson fathered the Big Ship co-operative scheme, has to date evinced keenest interest in the transport.

Whether foreign nations will get DC-4's remains a mystery. Certain it is that the Netherlands have a consuming affection

(*Continued on page* 82)

IS THE DIRIGIBLE DOOMED?

by HAROLD KEEN

Uncle Sam holds the world helium monopoly as well as the future of lighter-than-air craft. Yet, President Roosevelt recently shelved our latest dirigible design.

Even Commander Rosendahl, the dirigible's champion, is being forced away by the Navy.

LAST summer Commander Charles E. Rosendahl, the man who has made a religion of dirigible advocacy, was notified by the Navy Department that he stood relieved of duties as commandant of the Lakehurst, N. J. Naval Air Station. His new job, to conform with Navy policy of alternating periods of sea and shore duty, was to be as executive officer of the light cruiser *Milwaukee*.

Thus was effected the abandonment of a 15-year career of heart-breaking pioneering by America's foremost airship authority. Despite the fact that adverse circumstances, general public misunderstanding and a cool attitude of the Navy's high command had virtually doomed further lighter-than-air development on a large scale in the United States, Commander Rosendahl, on stripping the wings from his uniform, did not shed his faith in dirigibles.

He surveyed the ashes of the Zeppelin cause.

There were the shattered dreams of a new airship fleet to replace the ill-fated *Shenandoah*, *Akron* and *Macon*.

There were the unheeded arguments that, under certain conditions, the dirigible is the most effective scouting instrument the Navy could employ.

There was the futile long struggle for recognition in the United States of the commercial significance of lighter-than-aircraft.

But no tougher-spirited officer has barked orders in Uncle Sam's Navy than this straight-from-the-shoulder gentleman. If Commander Rosendahl is disheartened by the fact that his own country, with a virtual monopoly on helium—the only practical, non-inflammable lifting medium for airships—fails to pursue its advantages over the world, he doesn't wear his feelings on his sleeve.

With a leave period due him, he packed his bags and sailed for Germany to attend the celebration in Friedrichshafen of the 100th anniversary of Count von Zeppelin's birth. It was in the nature of a reunion with the small band of valiant men stunned, but not permanently discouraged, by the tragic loss of the *Hindenburg*.

It may also have been in the spirit of farewell that Commander Rosendahl went to Germany, cradle of the airship. For today he does not know whether he will ever return to dirigibles. The matter is entirely out of his hands. If he is to pursue the career of a Navy officer he must, for the time being and perhaps for the remainder of his active service, forego the work with which he has been identified as the nation's ranking participant.

Not long ago, I asked Commander Rosendahl aboard the *Milwaukee* in San Diego harbor about his plans for the future.

"I have a job to do here," he emphasized, "and right now I am submerging myself in line duty. Airships are all in the past now."

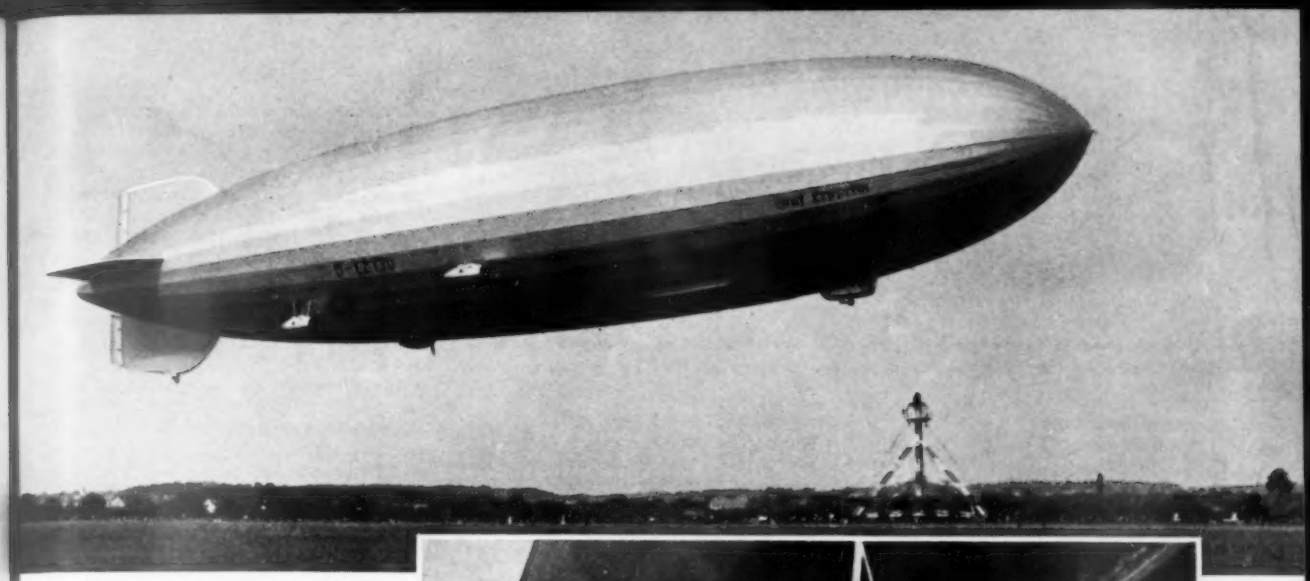
Today the nation's leading proponent of the dirigible as a Naval scout, aircraft carrier and commercial transport, is uncertain whether the Navy will ever again want to use his specialized talents. Next year his name appears before a selection board as eligible for promotion; if he doesn't stumble over this hurdle, he admits he would be jeopardizing his future by returning to lighter-than-air activity as a captain. In its orphaned status, dirigible service today calls for no higher a rank than commander.

Of course, a selection board "no" would mean automatic retirement.

Yes, he's at the crossroads of his career, a situation symbolic of the airship cause the world over in the year 1939. The simple fact is that a jinx has hounded dirigibles in their experimental period.

"The breaks have been bad and there hasn't been influential enough leadership to defend the dirigible when mistakes were made under naturally difficult pioneering conditions," Commander Rosendahl explains. "That is why, unless the American public, by understanding the inherent merits of the airship, keeps an open, unprejudiced mind during the formative years, the United States will toss

The disasters of the Akron and Macon spelled the end of American dirigibles.



The U. S. helium ban probably will keep this latest Graf Zeppelin on the ground.

overboard a promising project merely because it failed to meet with full success immediately. That does not seem to me the traditional American Way."

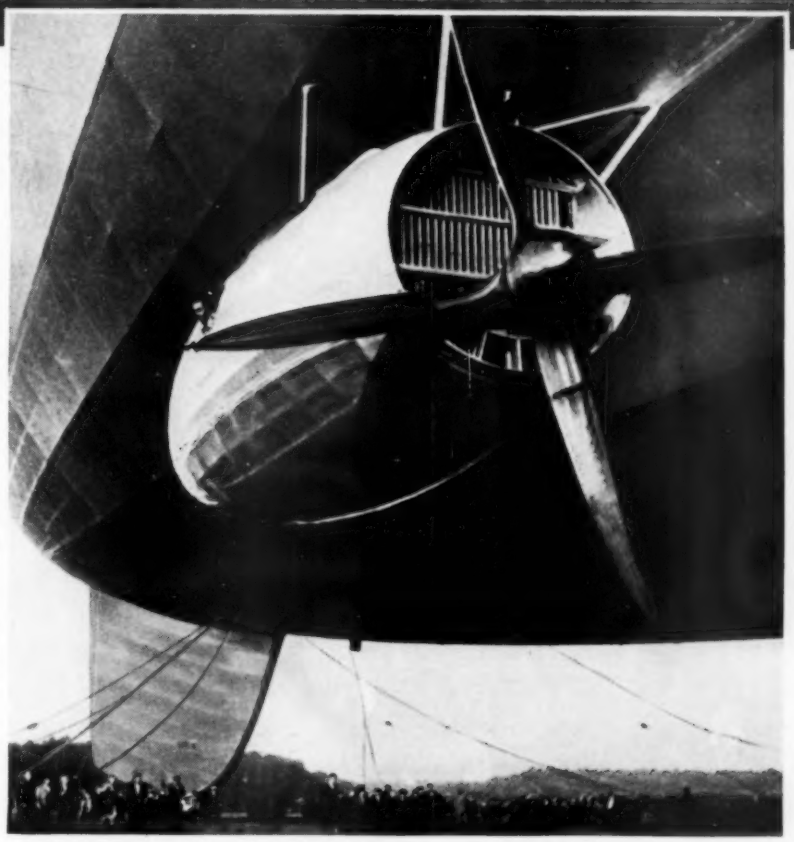
He points out that such innovations as torpedo boats, submarines and heavier-than-aircraft had greater difficulty convincing the overwhelming majority of scoffers. Remember "Fulton's Folly"? Steamboats supplanted sail anyway. Railroads, despite their fearful carnage in the early years, are here to stay. Why not give the same chance of development to dirigibles? The early catastrophies in heavier-than-air did not deter American pioneers from continuous effort in this new field of transportation. Why should lighter-than-air be an outcast?

It has been with hope in their hearts and a forced attitude of optimism that Commander Rosendahl and his small group of able aides have waged the fight to prevent a virtual outlawing of the dirigible. Because they are junior officers who do the work but have little if anything to say about the degree to which Navy airship policy is to be carried out, they can't provide the answer to the above questions.

Exactly what has been the extent of U. S. dirigible activity? In 1916, the Navy General Board, headed by Admiral George Dewey, recommended that in view of German successes with airships, "it is most necessary to develop dirigibles of this type as soon as possible." The Secretary of the Navy filed this letter. Another in 1918 met a similar fate.

Shortly after the War, with this country still minus any U. S.-built airships, the Navy officially became custodian of dirigible pioneering with the consent of the Army. A policy was drafted, committing the Navy to "build and operate rigid airships as necessary to determine their usefulness for Naval and other governmental purposes and their commercial value."

What has the Navy done since then? It built three airships, the *Shenandoah*, *Akron* and *Macon*, and acquired the *Los Angeles* as a training craft from Germany.

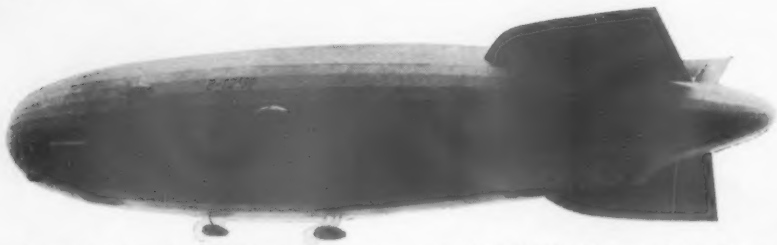


When Secretary of the Interior Ickes banned the export of helium to Germany for this new ship, fear of another Hindenburg disaster precluded the use of dangerous hydrogen.

Disregarding for the moment the military value of dirigibles, Commander Rosendahl contends that we are in no position to condemn the airship for commercial uses because we have never tested them as passenger and cargo carriers. On the other hand, the only nation which has done so—Germany—has had outstanding success with its *Graf Zeppelin* and *Hindenburg*, losing the latter in a disaster which would not have occurred had the giant bag been inflated with helium. For 18 years, American airship effort has been intermittent, bulwarked by no properly conceived long-range plan, Commander Rosendahl claims.

"I see no reason, simply because of setbacks so far encountered, to terminate our airship policy after 18 years of effort that was spasmodic at best," he told me with intensity of feeling. "We have gone as far as we can on paper; we must now launch a practical program of, let's say, three to five years, with no less than two large dirigibles and a new training airship, in addition to the *Los Angeles* in a recommissioned status.

"If, at the end of that time, all factors tend to show that the dirigible has no place in the Naval scheme, then I'll be the first one to say 'let's give up the whole idea once and for all'. But until



It would take 15 ocean-flying clippers at a cost of $9,000,000 (compared to about $4,000,000 for this dirigible) to equal the carrying capacity of a single airship.

we do that, we are not meeting the challenge being flung by the world at the United States as a helium monopolist."

His tiff with Secretary of the Interior Ickes over sale of helium to Germany still is echoing. Said Mr. Ickes:

"I am not persuaded that the supply of helium sought by Germany is not of military importance."

Countered Commander Rosendahl: "The airship does not belong in the military picture in Central Europe today. Germany is carrying on her plans for airship construction only for peacetime commercial purposes."

Again public opinion was on the opposite shore. Because the average civilian could not immediately realize that the dirigible is a Naval instrument of value only to nations with long coast lines or far-flung possessions to patrol and protect—such as the United States and Great Britain—Mr. Ickes' stand on withholding helium from the none-too-greatly-loved Nazis was applauded.

But the airship cause suffered. "The Germans, who would gladly have given us the benefit of the longest dirigible experience in the world in return for our export of helium, now are stymied by their lack of a safe lifting medium," Commander Rosendahl remarked. He pointed out, too, that the *Graf Zeppelin* and *Hindenburg* both had U. S. Naval observers aboard on many of their flights, during which they made invaluable observations of the most advanced airship technique in the world. This practice the Germans would have continued.

Pioneers such as Rosendahl and Eckener know nothing of political differences. Their own specific problems are the same and they seek to reinforce the other in surmounting obstacles. The greatest obstacle of all, at least in the United States, is the disfavor into which airships have fallen because of the *Shenandoah, Akron* and *Macon* disasters.

"The steady glow of all pioneering progress must occasionally be dimmed by mishap," comments the survivor of the *Shenandoah* loss. "We need only recall that railroads keep regular wrecking trains and rescue gear standing by at all times; navies maintain submarine rescue vessels and almost every airport has crash and rescue equipment available."

Unfortunately, advance must be made through trial and error. Admittedly there were errors which sent the only three American-built airships crashing to destruction, Commander Rosendahl concedes. The *Shenandoah*, for example, was carried up suddenly by rising storm currents near Ava, Ohio, when she failed structurally, broke in two and fell, killing 14 of the 43-man crew. Some time previously, to save weight, elimination of several automatic helium valves was approved. Had they been available in the emergency when excessive interior gas pressure collected during the rapid rise, the accident may never have occurred, according to Commander Rosendahl. As it was, the pressure weakened the airship's hull enough to render it easy prey to the squall.

"In the light of subsequent events," the Court of Inquiry found, "the reduction was inadvisable and was an error of judgment in no way involving negligence."

It was a costly mistake, but pioneering does not come cheap, you are reminded by Commander Rosendahl. The *Akron*, whose loss was doubly tragic because it carried to death Rear Admiral William A. Moffett—the only Navy officer of high rank, according to Commander Rosendahl, willing to risk backing the airship—was destroyed through a combination of circumstances. Although it fell into the Atlantic Ocean six years ago during a storm, the lightning theory has been discounted as has the possibility of structural weakness. Instead, other factors—such as inadequate weather information to warn the navigator of a low-pressure area, difficulty of obtaining quickly data on wind direction and velocity, vertical air currents which pulled the ship down twice in the last three minutes of her life, and an altimeter which did not give the true elevation from the sea—

(*Continued on page* 74)

Most successful American dirigible was the venerable U. S. S. Los Angeles. It is shown here being landed on an aircraft carrier at sea. The Los Angeles has been decommissioned.

I Learned About Flying From That! – No. 3

The author (left) is shown with Roscoe Turner during the London-Australia race.

By CLYDE PANGBORN

If any pilot has run the gamut of hair-raising experiences, he is Clyde Pangborn. He has settled down to the serious task of flight engineering, was recently married in London.

Clyde Edward Pangborn, barnstormer, test pilot, designer, stunt flyer and airline pilot, now is associated with Sir Cunliffe-Owen, plane manufacturer, at Southampton, England, where he has been for the past two years a consulting pilot-engineer. Born near the Washington state line 43 years ago, he learned to fly during the World War, served as instructor at Texas fields. The war over he went into commercial aviation, flying the first airplane into the Yosemite and making motion pictures. He barnstormed from 1919 until 1930 and, as partner of Ivan R. Gates of the Gates Flying Circus, flew from 2,500 fields and carried more than 100,000 passengers. In 1931, he spanned the globe with Hugh Herndon, Jr., flying non-stop from Japan to Wenatchee, Washington. He was third, with Roscoe Turner, in the London-Melbourne race.

FEW people know what goes on in a cockpit in those few seconds before a fatal crash. Part of the story may be told by the way the airplane acts in the air as a fatal maneuver starts—by the way it acts on the way down—and the way it strikes the ground. After it is all over, a body of inquiry meets and decides what *probably* happened. A theory is advanced based on certain facts which have been brought out at one of the hearings.

However, there never yet has been an inquiry which has revealed what has been going on in the brain of a man from the time he has gotten into trouble to the end. One can only guess how many pilots, caught in a circumstance or a series of circumstances which are new to them, have lost their power of reaching an intelligent decision. There is, in the brief instant between the beginning and the end of disaster, a need for quick thinking. But, more than this, there is the need of a cool head.

I have been flying for 21 years. My estimates of the time I have been in the air run to 15,000 hours. I have faced a great many emergencies. I have been caught in a fog cold enough to ice up my wings flying 50 feet above a railroad track in Colorado. I have had a girl suspended by an unopened exhibition or sack type parachute beneath the undercarriage of my plane—and I have had the stick come out of its socket while flying upside down at 100 feet in a JN4D. In the first case I landed on the tracks with some damage. In the second the girl was saved by pulling her back into the ship and in the third I managed to get the stick back into its socket and right my diving ship before shearing off my head.

All of these situations would have ended in tragedy save for one thing—I had an experience at the outset of my career which burned into my brain the need for being calm and reasoning things out in the face of what, at the time, seemed sure death.

I was a surveyor in Washington and Idaho when I enlisted in the Army. I had my ground training at Stanford University and in Texas, and wound up for my flight training at Lonoke, Arkansas. I drew for an instructor a man who shall be nameless. We hauled out a Jenny and my instruction began. It was always sketchy. The main reason for this was that my teacher knew very little more about flying an airplane than I did—and I knew nothing.

We stumbled along through gentle turns, take-offs, landings and so-on, until I was about ready to solo.

"What about spins?" I asked him. "Shall we do a few?"

He looked at me as if I'd slipped a cog.

"Why—I haven't done 'em myself," he said. "You get into one, and you may not get out."

"What do you do to get out?" I asked.

"You shove your stick forward and you kick opposite rudder—they tell me," he said.

So we went on with my course, flying figure-eights and 720's and making more landings until he told me I could solo. I got away with the solo and drew a ship to start building up time. One day

I took off, went to 2,500 feet and decided that what I needed was some nice, tight eights. I picked a couple of check points and started into them. I was shallow at first, gradually steepening the bank until my wings were well-nigh vertical. The spin came on before I knew it. I just fell out of a tight bank. The next thing I knew, the ship was standing on its nose and the ground was going around and around.

My first reaction was one of utter amazement. The ship was doing something that I didn't understand. I let go of the stick and grabbed the cowling. I looked downward, saw the ground coming up and chilled horror came over me. At that moment, I was ready to die —and letting myself die. Then, out of my panic, came three simple words:

"It's a spin."

A cold power of control came over me. To this day I can't explain it except to say that the fact I was on my way to death receded entirely from my mind and with it went the panic. I took the stick again. The ground was still whirling wildly and was much closer.

Then and there, I stuck my head down inside the cockpit. I began talking to myself.

"What was it ———— told me about spins?" I asked.

"You push the stick forward."

I shoved the stick forward.

"And what else?"

"You apply opposite rudder."

I did that.

The spin stopped and I was diving. I pulled the stick back and leveled off—not more than 200 feet above the ground. I looked down. Mechanics and pilots on the field were looking up at me. A crash ambulance was streaking across the field. Down below they'd figured me for a write-off!

I flew around some more. I went back up and did a few eights and then came in and landed. I was bawled out for scaring the boys on the ground. Nobody but myself ever knew that I had been staging a bout with death with my head inside the cockpit, figuring what to do with my hands and my feet. From that time on I went into spins again and again, kicking myself out and never again was I afraid.

Of course, it was lucky that I was at 2,500 when I started spinning. If I'd been at a thousand, they'd still be digging me out. But the lesson which I learned—and the lesson which has taken me through 15,000 hours of flying —is to keep a grip on yourself. Unless your ship is falling apart and you haven't a parachute, there's always a way out if you stop to give the matter some thought. As I said in the beginning we can only guess what goes on inside a cockpit before a fatal accident and trying to figure what the pilot had in his mind is even tougher. But, even being charitable, we can point to numberless cases where pilots apparently have lost their heads.

As I've pointed out, time after time in later years I've been in jams. And, always, my mind has turned back to that

(*Continued on page* 84)

Bossy Goes Air-Minded

EVERYONE at Floyd Bennett airport, near New York City, got a surprise and a laugh the other day. Members of the Navy aviation squadron had an especially good time, not to mention the merits of nice, warm milk. The cow apparently got the wanderlust, what with having to watch airplanes come and go day after day from her adjoining pasture. So one day she let her better judgment go hang and ambled through the pasture fence out onto the busy airport's concrete apron. There was great consternation among circling pilots until a band of Navy enlisted men caught up with Bossy. She apparently was very flattered by all the attention for she hobnobbed with the boys and even set up the drinks. It was a fairly sad moment when Bossy's owner arrived.

Darned Clever . . .

YOU'VE seen that old saying about the Chinese. There must be something to it, all right, for they fooled the cocky Japs for quite some time with "squadrons" of fake airplanes like that pictured below. Jap aerial observers spotted what they thought a powerful Chinese air base and dispatched bombers. Not far from the fake air base, though, was a real one.

HE WON'T STAY DOWN!

Jack McMahon has been paralyzed from the waist down for 13 years, yet he flies.

By M. H. CARRINGTON

If that rumor about flying's being superhuman still bothers you, here is a story worth your attention. Proving that one should not believe all one hears.

THIS is the story of a good man who refuses to stay down. He holds that *anyone*—and he emphasizes that by citing himself—can fly. It simply takes time and money, he says—and he's proved his theories by rolling up 100 hours of solo flying despite the fact that he's been paralyzed from the waist down for the past 13 years.

Our good man is Jack McMahon, a red-headed Irishman with all the wild spirits of an unbroken colt even though his legs don't obey him as well as they might. He was hurt when he fell from a trapeze while a tadpole of six years. He hasn't walked since without steel braces and a pair of crutches. But he's owned and flown his own airplane and expects to continue flying.

Jack succumbed to the flying virus while still in the hospital after his fall. But let him tell you himself:

"As it happened there was an airport right across the river from the hospital. This was way back when it was a stunt to fly at all. We kids spent many a pleasant hour watching the ships wavering up and down over the field. We finally managed to attract one of the pilots in an old biplane by reflecting the sun at him with a big mirror.

"It was a great day for me when he zoomed the hospital. The way the doctors and nurses came tearing out reminded me of the time I threw the big firecracker into the henhouse out on my uncle's farm. This pilot seemed a good sort of guy. Every few days when we were getting our sunbaths he would dive on us, wave and then climb up into the blue and put on a stunting exhibition.

"He left us gasping, the internes swearing and the nurses ecstatic. When the prettiest nurse in the ward looked at the ceiling and breathed that she thought pilots were simply wooooonderful I could see my future laid out in front of me as straight and firm as a sidewalk."

As the years went along Jack found that even with the disobedient legs he was in love with speed. In his early teens he acquired a motorcycle—without a muffler. As he puts it he "proceeded to wake up the town whenever I knew the local cop was taking his naps down in the firehall."

"I wouldn't swear to it but I believe that the dear people in our fair little city had a club nicely organized for the sole purpose of seeing that my parents received daily complaints about one in my condition being allowed to ride a cycle and operate a car just as if I were a perfectly normal human being."

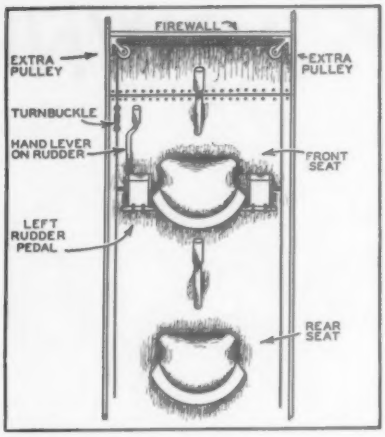
You can see what sort of a gent Jack is from his letter:

"It was this attitude of my townspeople that caused me to buy a *Cub* soon after inheriting a little money. I wasn't expecting to be able to fly right off the bat as other fellows do, because I'm accustomed to being a little behind when it comes to something that calls for the use of both arms and legs. I've never failed, however, to manage as well as the next guy if I'm allowed a little extra time," he says.

"There was a personal friend in my home town who was as interested in flying as myself. I had the money so we decided that he was to take the free flying course offered with the *Cub* and then teach me at leisure. The idea worked swell, too—for him.

"We went to Waterloo, Iowa, and I bought the *Cub*, taking my physical examination at the same time he did. In

Mr. and Mrs. McMahon both are air-minded. They are shown with the ship they owned.



This diagram shows McMahon's arrangement for operating stick and rudders by hand.

mentioning Dr. Hearst of Cedar Falls as the examiner I'm telling him again I haven't forgotten the great help he gave in securing my student permit for me.

"It took some time before the permit was granted. I believe I set a new all-time record for holding one's breath while waiting for that answer from the Bureau of Air Commerce. Meanwhile my partner had learned to fly and soloed, but we stayed on at Waterloo until he secured his private ticket and was licensed to instruct me without breaking any laws. When he passed his test we brought the ship back up to the old home town and settled down to the long and tedious task of teaching me the art of flying."

It was a tough job. Jack's feet and legs—long accustomed to doing nothing—couldn't operate the rudder bar.

"Day after day we kept at the old grind until I began to despair of ever learning to fly. I could handle the ship very nicely in the air because generally I didn't need rudder at all. But on the landings I needed help nearly every time to prevent a ground loop."

But they continued flying. Jack got some better. Finally he was shooting landings constantly—but having troubles and bouncing a lot. His partner—Chuck—took over the controls to show him a good landing. Jack says:

"He brought it in for a nice landing and immediately opened the throttle and circled the field again. This time he cut the gun and glided down as usual, but didn't hold the ship off the ground and set it down with his usual precision. He grinned at me and I laughed at him.

" 'Why can't you do it like that all the time,' he demanded. 'It wasn't good but it was better than most of those leapin' lenas you've been making.' It must have been the way I stared at him that woke him up. 'Say, didn't you make that landing?'

"I shook my head. Each of us expected the other to do the flying. I thought he was getting sloppy and he thought at long last I was showing improvement!"

Jack and Chuck decided they were stumped. Jack could have soloed if he could operate the rudder—but he couldn't do that. He believed the ship was a little too much of a luxury to keep hanging around if he wasn't going to be able to fly it. He was about to offer the *Cub* for sale when he hit upon the idea of a hand operated rudder.

"Other pilots offered the usual encouragement. 'Impossible. Too much to do with your hands alone.' I wouldn't be able to operate rudder and throttle with the same hand and do a safe job of flying. Old Chuck stuck with me, though. He thought that if God were with me it might be made to work," Jack writes.

There were several failures in trying to rig a working arrangement on the *Cub*. But finally one worked. They attached a lever to the left rear pedal and ran a continuous cable from the right pedal up around behind the firewall to the same lever. This primative arrangement allowed the pilot to give the craft right rudder by pulling back on the lever. Left rudder was obtained by pushing on the lever.

It was the sort of control that the first airplane designers used. The Wright brothers and Glenn Curtiss learned to fly operating rudder controls from levers not unlike Jack's. It's not surprising that Jack soon learned to fly well with his makeshift rudder.

"Chuck was doubtful about the whole thing but began to allow me more and more of a free hand," he says.

Then came the morning Jack soloed. Chuck was late. Jack drove out to the field. The ship was rolled out. Jack stood behind the propeller and pulled it through once. The engine caught at once. He warmed it up and taxied out.

"Ever sit in a ship with the motor running and had that urge to get going on your own? Well, between that urge and the Irish in me I just couldn't help myself.

"It was a beautiful May morning. One of those you read about in the love story magazines. There was the slightest breeze from the north——the long way of the field—and no obstructions for a mile. I headed into the wind and opened her up.

"I knew I couldn't fly, but maybe the ship wouldn't notice and would bring me back all right. At the 1,000 foot mark I eased the throttle back to cruising and looked out at the world with what I suppose was a very surprised look on my face.

"Scared? Nuts. I never felt better in my life. It was the most astonishing moment I've ever known. Here I was up on my solo hop and according to all the stories I'd ever heard I should naturally be shaking so hard it would seem like flying on a windy day.

"I dared another look at the ground below and in that moment I knew that dreams—even day dreams—sometimes come true. As I mentioned it was a beautiful May morning. Or maybe I may have been just the least bit afraid of my old bugaboo—landing. Anyhow I flew

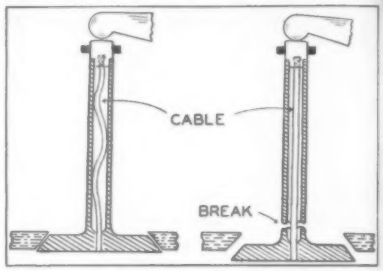
(*Continued on page* 82)

A Safety Valve

by Leslie Long

IF some manufacturer will develop and put this valve on the market he will be the means of saving many valuable lives and a lot of valuable property. Incidentally, he will make himself a lot of money doing it. The one weak spot in modern airplanes is the motor and the weak spot in the motor is its valves. During the time this writer operated a flying school, nine major motor failures occurred and of these eight were caused by broken exhaust valves. When a valve stem breaks the head falls into the cylinder and the piston proceeds to knock the cylinder head off, bend the connecting rod, ruin the piston itself and mess things up in general. Fires frequently follow such accidents. It is a bad business all around.

Because of all the trouble caused by valve breakage the writer tried to design one that couldn't act up in case it did break. The sketches show the



The Long safety valve.

scheme worked out. Unfortunately, there was neither time nor shop facilities to put it to actual test, but it cannot fail to work. The one question is manufacture. If not too hard to make it should be in universal use as soon as possible.

The scheme is simplicity itself. As can be seen, the stem is hollow like those used in salt cooled valves. Through this hollow runs a length of high grade cable that is purposely left a little slack. It is easy to see that when the head breaks off it will be retained by the cable. Because of the slack the head will drop a little and this will release the compression, thus cutting the cylinder out and warning the pilot of what has happened. The stem will of course be held in its guide by the rocker arm. Because of the warning cut out, the pilot is faced with nothing worse than a hurried landing—nothing like the usual rumpus that occurs when the motor "swallows" a valve.

It is true that valve manufacturers have improved the quality of steel and their manufacturing methods until modern valves can take a vast amount of punishment, but they still break and always will. With that thought in mind some one should try this idea. The one thing that may cause trouble is the method of fastening the cable at the ends, but no doubt some way of welding

(*Continued on page* 80)

This is Buell Phillips beside one of the ships he flies. To date he has 4,000 hours.

FLYING HIS WAY THROUGH COLLEGE

by H. D. ROBARDS

Being a capable pilot and desiring to get a doctor's degree in college might not mean much to the average fellow. But Buell Phillips has combined the two nicely.

IT'S quite a hop from skipping over cotton fields to "dust" them, to flying over Arkansas' Ozark mountains in search of education. But that's the kind of hop that Buell Richmond Phillips has made and is making. He's going to fly into being a doctor. He's located at the University of Arkansas in Fayetteville, taking premedic work. But at the same time he's a professor in his own right. He's giving flying instructions to a dozen students and the tuition pays his way through school.

There's no catch in it, either. Phillips is a licensed transport pilot with some 4,600 hours in the air; he had more hours than did Lindbergh when Lindbergh flew to Paris. Today he's only 30 years old. He learned flying when he was 15 years old while a sopohomore in high school. He played with model airplanes before that, back in the days when model planes were few and far between. His flying instructor was his brother-in-law, Floyd Munsey, one of Oklahoma's first commercial pilots. His first training was obtained in Duncan, Oklahoma, where his brother-in-law was stationed as pilot for an oil company which was an early commercial user of airplanes in the oil fields. Besides his brother-in-law, his family includes another flyer—his sister, Mrs. Vic Miles, Jr., whose husband is at West Point. She had 2,000 hours in the air at the time she married.

Buell Phillips flew into and out of about everything from Mexico to Canada before he fully determined to study medicine. He's positive that that determination wasn't influenced by a belief that flying accidents will bring the physicians many, many patients in the future. There's no reason for him to anticipate accident-patients; he's never had an accident worth mentioning. He flew for the first commercial airline in Oklahoma. He served as pilot for several different plane owners for a number of years. He dusted cotton. He trained for an endurance flight—only to have the flight canceled when his partner cracked the plane up the day before the endurance flight take-off. He helped his brother-in-law prepare for the second recorded attempt at taking a plane off from a moving car—only to have that attempt canceled by a crack-up. But Phillips was not piloting either plane at the time.

In fact, he has a very select record of safety and he is one of the few pilots in a very select class—those who have had planes stolen from them. He did bend the tip of one propeller. His most exciting moment in the air was when he flew through a power line which served a number of cotton gins along the path of cotton-dusting work, which begins way down deep in Texas and follows through into Missouri as the season advances. But the net result of that was to put the cotton gins out of commission for about half a day while the cotton-duster went merrily on his way.

It was back in 1929 that he went in training for the endurance flight, preparing for seemingly endless days of eating, sleeping, flying—and wondering when the motor will quit. His partner in that effort was Howard Bryant Andrews, and the plane was the *Miss Seminole*. That was for Seminole, Oklahoma, which was then at the height of its oil boom, and the oil operators were more than willing that the endurance attempt should be made in the oil city. However, Andrews was injured when the plane cracked up on a test flight the day before they were to start the endurance test, and such an anti-climax killed all favorable publicity which had been given the stunt. The attempt was not revived.

(*Continued on page 62*)

MEET Mr. Wilson of the AIR CORPS

When there's dirty work to be done, "Mr. Wilson" does it—and capably.

This is the story of the enlisted man in the Army Air Corps. He's the backbone of the air force, yet you never hear of him. He really is quite an outstanding fellow.

In the December issue the author followed a Lieut. Joe Smith through several years of his career as an Air Corps pilot. Joe really was a composite of three young reserve officers, one of whom eventually received his regular commission and is in the Air Corps for life and wouldn't swap jobs with a millionaire. But what about the non-pilots—not the aerial glamor boys but the lads who keep the planes a-working, the mechanics? Where do they fit in? Aren't they worth reading about? All right, then, we give you a high school classmate of one of these Joe Smiths. Tom Wilson also is in the Air Corps. He's no composite, but an actual character, although his real name is different from that in these columns.

TOM WILSON got his first surprise when he tried for the Air Corps and found there wasn't a single vacancy. However, they'd examine him physically and in every other way, because vacancies were expected soon and they took the likeliest qualified candidates. His second surprise came when two other lads who were taking the exam with him failed to pass. Seemed they were mighty particular whom they took in for 30 bucks a month. You'd think he was asking to pilot one of their planes. His third surprise was occasioned by the fact that it wasn't 30, but 21 a month, that they gave you at first.

The recruiting sergeant wouldn't commit himself as to when and how often the raises came, except that they came oftener than in other branches. Not right away, of course, for Tom would be doing recruit drill and learning the routine of the soldier. Ah, that was the catch, like his Uncle Dan had warned him. You sign up and then what? Handle a rifle and maybe never see an airplane. But others made it. There was that toolmaker at the factory whose brother was doing fine as a technical sergeant or something; he had a house thrown in, too. That "no vacancy" was a good sign. Those already in must like it to stay in. He hoped he was O.K. He was.

Two weeks later came a call from the sergeant. Two *days* later Private Tom Wilson, with a serial number a yard long, was sitting down to his first Army meal. Yeah, it was all right, the lad on his left admitted, although not as good as at Maxwell Field—there's where they fed you. Primed by his Uncle Dan's World War reminiscences, Tom wondered when the beans and the salmon would come around. The meal before him was a lot better than you got at Nick's and more plentiful than in the factory cafeteria. There were seconds, too.

"Boy, do you stand out as a rook," the man on his left spoke up again. "Go back for thirds and everybody'll be sure of it. Never was a recruit couldn't stow the chow. I've been watching 'em do it for five years now."

This talkative lad seemed friendly-like; maybe he'd answer some questions.

The Army's highly specialized technical school is at Chanute Field, Rantoul, Ill. This is a section of the engine division in which would-be mechanics are trained.

On the grease-smeared enlisted man the Army pilot must stake his life and ship.

By Major Roland Birnn

"It was lucky he got in this squadron if he wanted to work around airplanes."

Would he? The information, much of it passably accurate, came almost too fast to absorb.

It was lucky he got in this squadron if he wanted work around planes. Headquarters squadrons were all right for clerks and trick specialists and the service squadron was okay if you liked shop work. But the regular squadrons were the ones for airplanes—and flying too. Sure, anybody could go up, about as often as he liked. Long trips too. Chances for promotion? A gamble. Himself? Well, he'd be finishing up his second three-year hitch soon and was promised a corporal soon as he'd re-up. Now he was a private first class, specialist fifth class; pulled down $37.50 a month plus some flying pay now and then. Never saw nearly all of that at the pay table. Too easy to get credit—"jawbone"—for movies, haircuts, bowling, pool, odds and ends you had to buy.

The First Sergeant? No, he wasn't so tough, except when you tried to pull a shennanigan. In fact, the only disagreeable sons in the outfit were those with stomach trouble. The officers? Well, the Old Man he'd been at it since the year One. The Engineering Officer was the best of 'em all. Worked the hide off you, but you thought it was a privilege. *And* a *pilot!* But how about locating in the next bunk? I'll get it fixed up. All right?

All right with Tom. This fellow, name of "Dutch" Wilberman, hit it up pretty good with Tom. For the next five years they were in the same squadron and they were pretty close.

Recruit drill came right after dinner every day. Dutch conducted that in the squadron. The First Sergeant was watching him and Dutch wanted his corporal's stripes—*and* the 40-odd dollars pay that went with them. The other recruit instruction—hygiene, customs of the service, care of equipment—following drill every afternoon was in charge of an older non-com. It was less *un*interesting than the eternal "squads right", "column left", "right face", "hand salute" out on the concrete apron back of the hangar.

In the mornings Tom formed part of the general hangar crew, not assigned to any particular plane as yet. Mostly he swept out the hangars, pulled wheel chocks, put 'em back, gassed up, cleaned drip pans, washed down and pushed planes in and out of hangars. Except one morning after being three weeks in the service. "Wilson", there was his name in a different place on the fatigue roster, under "K.Ps". Well, his Uncle Dan had warned him.

Every eight or nine days thereafter for a long time his turn came for that onerous scullery job in the squadron kitchen. Some of the bunch didn't mind, but Tom never could scour the pans quite clean enough for the Mess Sergeant. After two months, when he'd finished his recruit training he came due for guard duty. That wasn't hard, but monotonous; it came every couple of weeks.

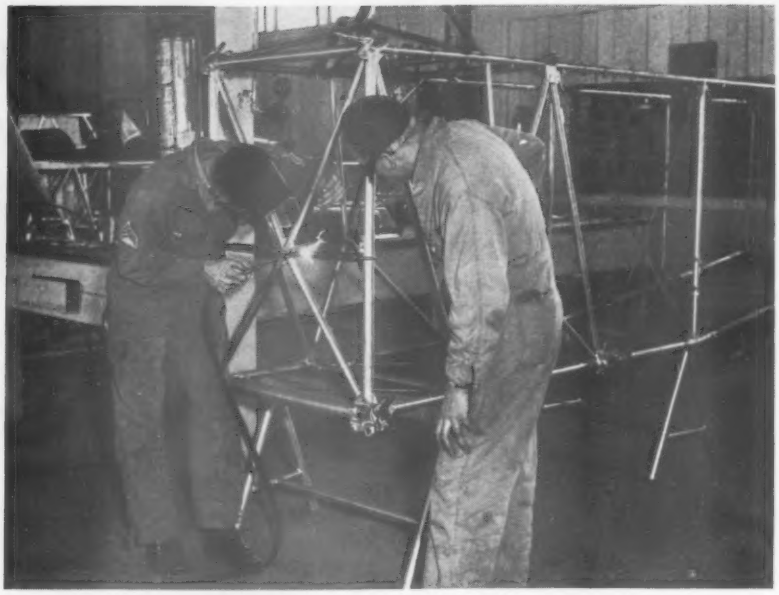
The first day he came off guard he saw his name shifted again, this time to "B-10 number etc." Second assistant chambermaid to a Martin, as Dutch described the job. Working for the redoubtable Scotty, the B-10's crew chief. Scotty was a fine mechanic, maybe a little impatient at times. He watched the way you handled tools at first to size you up. Scotty explained the set-up regarding pay and gravy a bit more accurately than Dutch.

"You're lucky, going through high school like you did. It honestly takes some schooling to get the hang of these technical orders they shoot at you. Kid, you try for the Technical School at Chanute Field as soon as you can. Look at the ones who have the mechanics' ratings; most have been through that school. I had a pretty hard time of it when I went through some years ago, because I only had a year of high. Now you practically *have* to have some real schooling to get along in the Air Corps. In fact they're trying not to enlist anybody who hasn't got himself four years of high."

Tom was keeping a record of his flying time. He got plenty. Lieutenant Ranter, for instance, when the squadron went one night for a five hour flight

The Air Corps enlisted man can learn many well-paying trades. and become highly proficient at them. Below is an expert machinist.

Photography is becoming more and more a vital part of Army aviation. Enlisted men interested in photography go to photo sections.



Aircraft welding, one of the most important phases of the industry, can be mastered by Air Corps enlisted men. They must do all repair work on Army planes in the field.

Armament is one branch or Army aviation in which the ground man can specialize. The above armorers are repairing machine guns and (below) testing them on ground ranges.

took Tom along. He almost froze, up there at 13,000 feet, but it was worth it. But no long cross-countries. Later on, maybe. He might even get flown home and see the family.

But this Chanute Field. That was the important step. Should he speak to the First Sergeant about it? Not mention the monotonous or dirty work (rated air mechanics in that squadron didn't do guard or K.P.) or he'd think Tom was a goldbrick, but just see what the chances were. A week later he broached the subject to the hangar chief, old Sergeant Fells.

"You ask the Top Kick for a form you fill out. Every six months we have an exam to pass on eligibles. Comes a vacancy for the school and we generally take the man who's been eligible longest. Got some good men on the list, with lots more service than you and more are qualifying every exam, but go to it." Tom did. There were 20 men out of the 132 in the squadron who were then on the list. The Engineering Officer, Lieutenant Dollivar, questioned him as to his qualifications, experience and things in general, told him he should easily qualify but that in the past year only ten men from the squadron had gone to the school. No one with less than two years' service stood much chance. Chanute just wasn't big enough to satisfy the demand. Everybody was studying to qualify, now that the courses there were getting more difficult.

The lieutenant was right about the studying. About 20 men were spending more or less all their spare time at it. One for flying cadet entrance, six for Chanute Field entrance, the majority for the coming air mechanic's exams, and one lad was even going to town five nights a week and taking a straight college course for a degree. One thing about spending your evenings studying, your pay went further. There was a file of technical orders, manuals, pamphlets of all sorts in the day room—the soldiers' community living room in the barracks.

When the eligibility examination was held Tom qualified without any trouble.

There was rumor of maneuvers in Florida. Only two men to a plane would go. The rest would stay behind to do various overdue clean-up jobs, from painting the mess hall to cutting grass and grading around the hangars and quarters areas. Scotty's other helper, a married man, thought they'd be in Florida over Christmas and wanted to spend it at home instead. A switch in names was made.

It was a fine flight there, the first long one Tom had had. For a while he followed the route on a map, but lost it in shifting maps. Thereafter he had no idea where they were until they landed for gas.

The low state of his finances crimped Tom's complete enjoyment of Florida in December. However, the American Legion and other civic bodies handed out much free entertainment to the men—wrestling matches, a barbecue, a dance, a fishing trip for some of them. It seemed like everything came in bunches.

You plug away for awhile and then things happen. The Squadron Commander handed out good news.

. "Didn't have time to notify you, Wilson, before we left, but you're getting your Specialist 6th Class starting today. Three a month extra. You know you're also drawing flying pay until we return home at least."

Scotty took an entirely practical view of the situation.

"This flying pay! You risk your life for 35 cents a day. *Your* life ain't worth any more, but me, I'm a sergeant with an air mech's rating and I don't get any."

"If I had your pay—"

"Well, this air mech's pay really includes flying risk. Anyway we get a winter vacation in Florida, but on the other hand the food can't compare with that back at the barracks. The bunks ain't as comfortable, but then there's the free entertainment. Free beer, too, I hear."

"You mean, you *hope*."

The next day Scotty, survivor of a forced parachute jump, two bad crashes and a life of rough adventure, absentmindedly stepped off a wing, lit on the concrete apron and got up with a broken arm. You'd think old Fells had the accident to hear him holler, about "clumsy so-and-so's and who's going to take care of Scotty's ship?" You didn't ordinarily speak up to him when he was wrought up, but—

"Hey, Sergeant, how about me?"

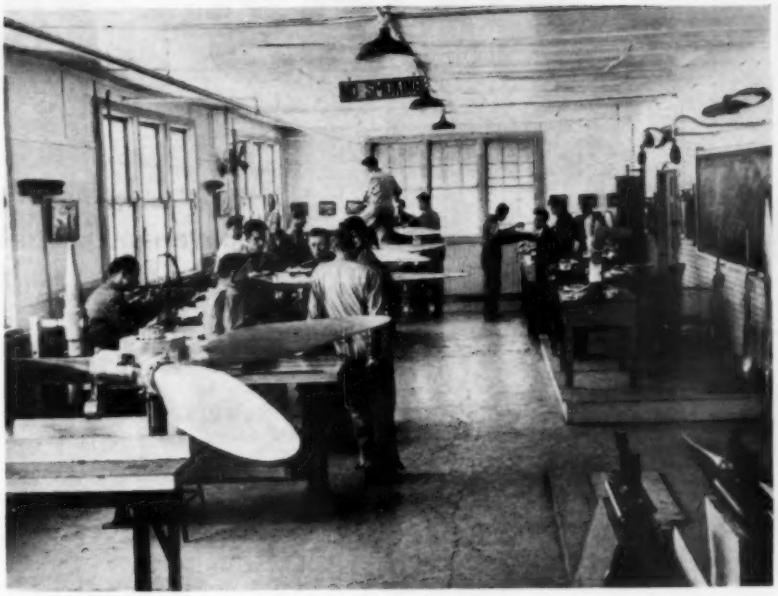
"You? A-a-ah, what makes you think you————" the old man walked away, consulted Lieutenant Dollivar but soon returned. "Take it. I'll oversee your 20-hour inspections—and don't you do anything serious without first asking me. If we weren't on maneuvers we'd put a ship that size out of commission before we'd trust it to a greenhorn alone."

So Tom was just about a Crew Chief. Not bad.

Apparently his work in Florida had some later results. In the months to come he received a healthy portion of the flying pay available in the squadron and was moved up to be Scotty's first alternate when the married man wasn't re-enlisted on account of his dependency. And more cross-country flights. It was old stuff to Scotty and now that Tom could handle things fairly well the latter often accompanied the crate on fairly long trips. He had moved up to 5th class specialist after a year in the outfit. But he missed the friendly blackjack games with Dutch, who was now a corporal and who did his card-playing with the other non-coms. He was also eligible for the Air Mechanic Second Class examination, and took it as soon as it came around. As he expected, he flunked out on two things; ignition and a knowledge of technical data. Every six months, however, he automatically requalified for the Technical School entrance.

Promotions came more rapidly now. Every time the top promotion was made in the squadron about 10 men consequently moved ahead slightly on pay.

(*Continued on page* 84)



The modern, complicated propeller is another phase of aviation in which the ground man can specialize. Above is a propeller division of an Air Corps technical school.

Aircraft radio is, of course, one of the most highly specialized branches of military aviation. These enlisted men have access to and training on the finest of equipment.

BUGS IN THE

Perhaps the airplane will be the means of discovering the cure for hay fever. Many startling facts have been found in the sky.

Several airlines have cooperated wholeheartedly with Mr. Durham's research.

SHOULD you be at an airline terminal some day and should you spot a tiny streamlined gadget that resembles a gun clamped to the first officer's cockpit window, don't be alarmed—it's a bug collector. Sounds fantastic, but still don't be alarmed because the airlines have not gone into the bug-collecting business. They are assisting in a nation-wide study of aerobiology that is being conducted by O. C. Durham, chief botanist of Abbott Laboratories.

Last summer Mr. Durham started his experimental work in cooperation with United Air Lines—his specific study was to determine the heights to which ragweed pollen (hay fever germs) and other microscopic particles ascended. In collaboration with his own engineers and those of United's research department, a special slide holder was designed. Glass slides, covered with petroleum jelly to catch the tiny particles, were placed in the holder at intervals by the first officer and after exposure were handed to Mr. Durham, who was granted permission by the airline and the Civil Aeronautics Authority to occupy a small jump-seat just behind the pilots' seats on Douglas DC-3s.

After he had assembled all the data collected on flights between New York and Denver, Durham revealed some very interesting conclusions that the air transport industry will doubtless use to advantage during the height of the approaching hay fever season. Durham definitely established that the vegetation germs that inflict hay fever to those allergic to it do not rise as high as the cruising levels of modern transport planes. Accordingly, hay fever sufferers can travel in complete comfort by plane and not be affected by these pollen germs. He discovered, too, that by some queer twist in the ventilating systems of the DC-3s that even at lower altitudes where particles were picked up on the slides, none of these germs entered the cabin.

So inspired were Durham and his associates by the results of the 1938 study that an even greater study will be conducted this summer to cover a large portion of the United States to determine distribution of hay fever pollen—with emphasis on altitude. In every corner of the country, offices of the U. S. Weather Bureau cooperate with Abbott Laboratories by exposing slides on the ground and there is nowhere that Durham travels during the summer months that he does not have slides attached to his automobile. He is always accompanied by a microscope with which he examines slides after exposure.

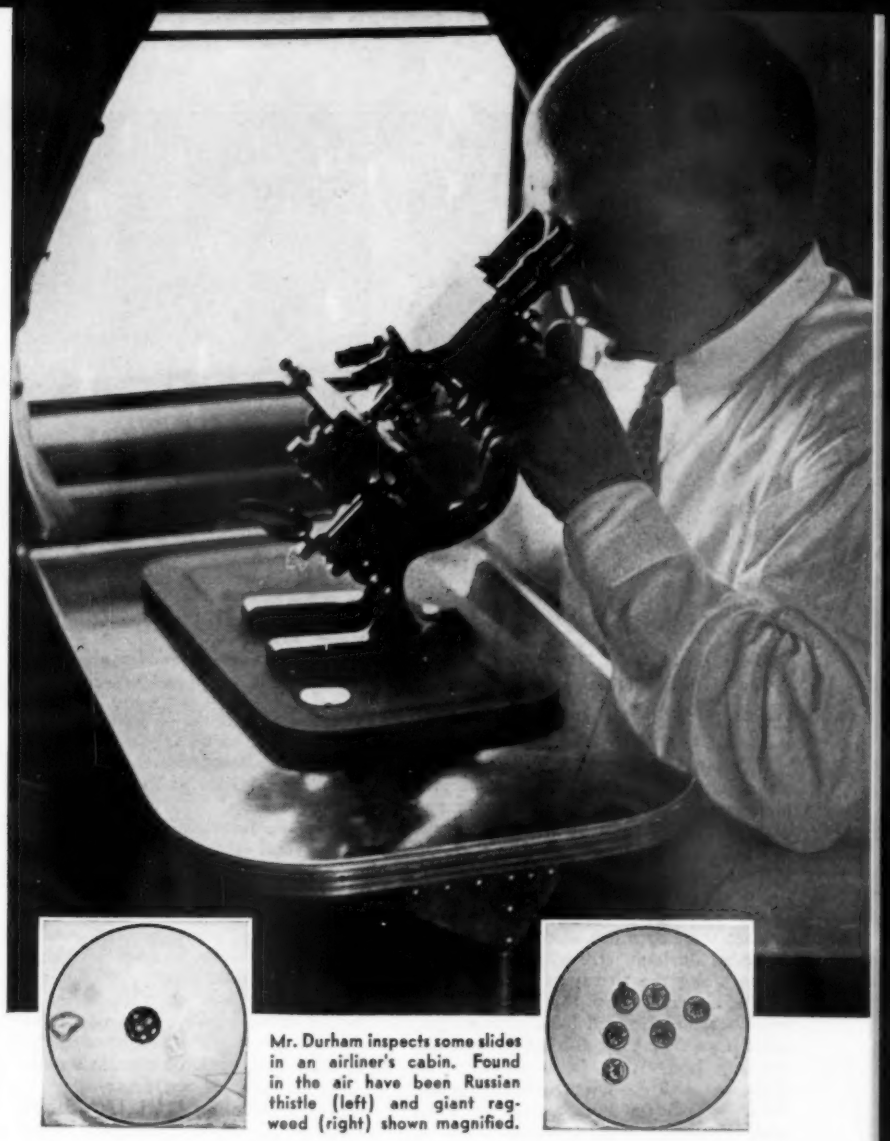
As this is written we were at the Chicago airport to see Durham leave for Richmond, Virginia, by plane. With him was the streamlined slide-holder. He had made arrangements in advance with the airline to be in the pilots' compartment to supervise the changing of the slides. He tries to fly in clear weather whenever possible. Rain washes these germ particles out of the atmosphere and makes exposures useless. Then, too, in clear weather, the pilots have a bit more time to devote to slide-changing than they do while navigating on instruments.

Oceanic exposures will occupy some of Durham's studies this summer on his never-ending search for germs. There is a good possibility that Pan American Airways will install one of his holders for these exposures on one of this summer's Atlantic flights of a Boeing "314." A friend who is flying up to the Arctic Circle, deep in the Northwest Territory, is planning to take one of Durham's "big

Mr. Durham (second from left), two assistants and their United Air Lines pilot inspect slides exposed at various altitudes on a flight from which they just landed.

WIND

by
GEORGE W.
MASON



Mr. Durham inspects some slides in an airliner's cabin. Found in the air have been Russian thistle (left) and giant ragweed (right) shown magnified.

guns" along to expose slides. No aerial work in studying pollen distribution has ever been conducted in this region. Nearly every domestic airline in the country has heard of Durham's work and all are eager to cooperate, both from a scientific standpoint and from the standpoint of getting a new sales twist for air travel.

Not being a hay fever sufferer or being allergic to anything except myself we can't personally appreciate the great contribution which Durham is making. To those who are such sufferers and who have been told of Durham's studies, they are quick to compliment his work. It already is leading to some control of hay fever by stamping out the ragweed pollen in its early stages before it is gathered up by the drying summer breezes and whirled into the atmosphere.

The history of aerobiology is extremely interesting and new. Less than a century ago nothing was known about these invisible particles. Pasteur was the first to crusade in a doubting world to convince medical authorities that these particles were floating in the lower strata of air. He was the first to calculate the number of particles in a given volume of air. By climbing mountains he was able to make such counts up to as high as 2,000 feet above sea level. The next development was made by an English doctor who exposed oil-coated slides at ground level—the pollen being deposited by the slow pull of gravity. But this was haphazard at best.

This Englishman—Dr. Charles Blackley—became curious about the pollen content of the air above the ground and conceived the idea of sending slides aloft in kites. This was long before the Wright brothers' conquest of the air and the kites were not satisfactory, since they did not ascend much above 1,500 feet. The airplane brought about a more satisfactory method of studying air content and by 1921 a number of experiments had been carried on from balloons and planes.

Twelve years later this work attracted the attention of Colonel and Mrs. Charles A. Lindbergh, who cooperated with the work done along this line by the U. S. Department of Agriculture. The Lindberghs flew to Europe over the northern route and exposed a total of 27 slides over Greenland and the North Atlantic, picking up numerous kinds of particles. Among those in the Department of Agriculture who were interested in Lindbergh's work was Dr. F. C. Meier, who had been responsible for numerous other upper air studies. It was Dr. Meier who named this new science "aerobiology" in 1937. He and Dr. E. B. McKinley were engaged in discovering the organic content of the air over the Pacific Ocean when they were lost on the ill-fated *Hawaiian Clipper*.

Though conducting his work under Abbott Laboratories, Durham is by far the leading figure in aerobiology and his work will probably cover a greater area than has ever been studied from the air before. Short and stocky, Durham talks with an enthusiastic, crisp voice that gives the instant impression that he is a true scientist—more interested in the final results than in the attendant prominence which his studies attract.

On the 1938 flight from New York to Denver, Durham covered more than 3,000 miles. Slides were exposed over nine states at levels up to 9,700 feet above the ground. During climbs and descents exposures were kept in the slipstream for five minutes. Longer exposures were made in cruising levels, but all exposures were made on the basis of five mile exposures.

There were no heavy deposits found above 5,000 feet, although some allergenic particles were sometimes found up to 7,500 feet and a few at 9,000 feet above the ground. Over Iowa, where an abundance of pollen and spores float through the atmosphere at low levels, the air at 10,000 feet was entirely free from any particles of the type which Durham is constantly searching for. The same was true at all other points—but all the time, at all levels, there was no contamination found on slides exposed inside the cabin. There are too many different forms of pollen and spores to be enumerated here, but it is interesting to note that 87 different slides picked up 36 types of particles. each capable of causing inhalant allergy.

Durham proved most conclusively that a cloud layer, whether unbroken or broken marks the limit to which upcurrents can carry pollen. Thus the pollen ceiling on a cloudy day is the same as the cloud level. This is not so, however, on a cloudless day and these

Above is the latest "streamlined" version of Mr. Durham's slide-holder for airplanes. One of these will seek upper-air pollen data aboard one of Pan American's clippers.

particles often climb to seven and eight thousand feet.

In discussing his 1938 findings with airline officials, Durham said: "The airplane offers the ideal means of immediate escape from pollen contact en route to a pollen-free area when other methods of relief are found to be insufficient."

No single scientific experiment, conducted in conjunction with the airlines, has attracted as much attention as those made by Durham. He will be a familiar figure along the airways of the country this summer during the dreaded hay fever season. He will be easy to recognize; if you're an air traveler you might not see him, since he'll probably be riding up with the pilots (if it's a Douglas DC-3). But at the airports you'll see him, clutching his microscope under one arm and a box of exposed slides under the other. Between planes he peers into his microscope, examining exposures just made—a note is made on each slide and then sent back to his laboratory, where he makes a more careful examination of each individual slide at the close of the hay fever season.

Still in the future is expansion of his work beyond the United States and North America. Durham has his eye on South America for next winter, when the pollen season is at its height down there. He plans to send some of his slide holders to several South American countries to be carried on a number of different air routes.

A real salesman for air transportation is Mr. Durham. Thousands of people daily read his reports on the day's pollen count in the Chicago newspapers.

As for those who travel, Durham has been one good word for them—"fly." There are no "bugs" up where the airliners cruise.

END

This is the original vise-like slide holder. A few allergenic particles have been picked up by this device as high as 9,000 feet. Average top, though, is 5,000 feet.

The Light That Failed
by Lee Windward

INTEREST in transatlantic flights was at one of its peaks during the summer of 1927. At that time, while serving as radio operator on a 16,000-ton passenger ship, I was witness to the wildest acclaim per person ever given to an ocean flyer.

The mild form of excitement which causes spectators to throw telephone books, torn or untorn, on a hero riding up Broadway, is as gentle sleep compared to the marine madness occasioned by this tiny blinking light over the Big Drink.

We were going westward, with New York two days ahead. I copied a radio report from Devizes, England, announcing that two European flyers planned to hop off from Horta, Azores, within the hour, in an attempt to reach New York. I sent the notice to the bridge. When the news was made public, it spread over the ship as rapidly as an ink spot on a light suit.

A ship three days at sea can be very dull; all news gets more attention than it deserves. The dispatch was leaped upon avidly by the stewards who were the flyers' countrymen. The skipper was interested because the smell of publicity was in the air. He was jealous of some of the other Atlantic navigators who had just made shipboard rescues, and, while I would not go so far as to say he actually *wanted* a plane to flutter down helplessly within lifeboat distance, those who knew him best said he was possessed of a decided hero complex.

Interest grew in all quarters. A group of passengers, air-minded but lightheaded, predicted the course of the flight. After two hours, with the aid of a chart, a slide rule and a quart of Cointreau, they set 10 p. m. as the time the airplane was to pass over us.

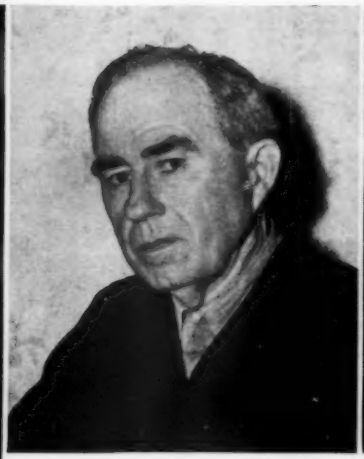
The flyers had a signaling light but no radio, so the skipper had the boatswain paint our latitude in five-foot letters on a forward hatch cover, leaving a space for longitude, to be filled in when the plane was sighted. Searchlights were trained on the figures so they would be easily discernible.

Seamen were posted on the after decks at sundown, with orders to report anything that flew past—except time—to the bridge. So many passengers were leaning over the rails that the seamen were crowded away. An order to the radio room demanded the Chief stand a "strict airplane watch" (which provided us with the trip's best laugh).

That night at 8 p. m., movies were shown to 10 rows of empty seats. The run was stopped after the first reel; the projectionist was also the airmen's countryman, and his heart was not in the second reel of *Purple Passions,* but with his *landsman,* roaring westward toward him over the ocean.

Nelson, a fourth officer making his first trip with stripes, was on watch. He kept his night glasses trained on the port

(*Continued on page* 86)



These Texans took part in the project. Left to right are L. B. Hess (with stock certificate), Rowe Lockett and P. W. Thorsell, Ezekiel vice-president.

It's an unusual tale, this about a flying machine built by directions from the Bible. The Reverend Mr. Cannon might have altered history.

They Almost Beat the Wrights

By SARAH McCLENDON

THE little east Texas town of Pittsburg and not Kitty Hawk, N. C., might have witnessed the first successful heavier-than-air flight if investors had been able to bolster their faith in a strange biblical flying machine at the crucial period of its development in 1901.

But all too often moneyed folk lack the visionary enthusiasm of the inventor. Traditionally they cannot see beyond the stark reality of the dollar mark. And so the Ezekiel Air Ship Manufacturing company of Pittsburg, which for a brief moment held the international spotlight, folded up. A monster flying machine was designed according to the first 10 chapters of the Book of Ezekiel, but it never left the ground. Its creator, the Reverend B. Cannon, broken-hearted, sought new fields for his endeavors and the $20,000 worth of ornate, glittering stock certificates became mere souvenirs of a great experiment.

No fly-by-night promotion venture was the Ezekiel Air Ship Manufacturing company. Not only was it inspired by the Word of God but its guiding light, the Reverend Mr. Cannon, enjoyed the full trust and confidence of the townspeople. Ready purses kept the company's treasury operating for a time and once Pittsburg's faith in the venture was reflected by a phenomenal rise in quotations of the stock, which brought as high as 4 to 1.

Old-timers now in Pittsburg agree that, for a while when excitement over the new airship company was at fever heat, the streets of Pittsburg and neighboring communities buzzed with gossip and predictions about the big flying machine. Traveling men and hundreds of tourists flocked to the town to see the strange mechanical bird.

It is rather well authenticated that the German government in 1901 offered $100,000 for the patent rights covering the projected Ezekiel airship. A bull market resulted from the offer. Lacking in proof, however, is the report that Orville Wright came to Pittsburg the same year to get ideas on airship construction. That was two years before the historic flight of the Wright brothers at Kitty Hawk.

Though the Reverend Mr. Cannon has been dead for several years, some of his surviving associates still insist that he was ahead of his time; that today he would have been hailed as a mechanical genius. Nevertheless his backers clamored for results and after nearly two years of fruitless toil, the builder loaded the huge machine on a flat car, headed for St. Louis. The contraption never reached its destination. It is said to have been sidetracked at Texarkana and eventually destroyed in a storm.

The Reverend Mr. Cannon then went to St. Louis and later to Chicago and friends in Pittsburg credit him with a successful flight in Chicago in an airship of his own invention. But the Wright brothers already had the spotlight, so the Texan was destined to remain an unsung hero. Later he returned to Texas and became a mechanic.

No one in Pittsburg doubted the sincerity of purpose of the inventor nor his genius as a mechanic. The little town backed him to a man and the feeling still exists that Cannon came almost within a stone's throw of international and lasting fame.

Rowe Lockett of Pittsburg, who helped to build the first airship, said the principles of design were sound but the trouble was largely in the motive power.

"A gasoline engine was to be used for the propelling force," Lockett explained, "and it must be remembered that Cannon had to start from scratch in designing the mechanism. The only available engine at that time was far too heavy even to be considered. So Cannon had to build one of his own, suited to his purpose.

"He designed and turned out his own fittings, but with all his cleverness he could not surmount the thousand and one obstacles to success. Probably with plenty of time and money at his disposal the outcome would have been different. I regarded him as one of the greatest mechanics of his generation—and far ahead of his times."

The second floor of this machine shop was where the Ezekiel "airship" was built in 1901. The ship itself was "about 18 feet wide and 25 feet long", wheels six feet high.

Bit by bit the Reverend Mr. Cannon pieced together his airship from the description set out by the prophet in the first ten chapters of the Book of Ezekiel. Particular attention was given to the biblical account of how the wheels were to be constructed.

"The appearance of the wheels and their work," according to the Scripture, "was like unto the color of a beryl; and the four had one likeness; and their appearance and their work was as it were a wheel in the middle of a wheel. When they went they went upon their four sides; and they turned not when they went.

"And when the living creatures went, the wheels went by them; and when the living creatures were lifted up from the earth, the wheels were lifted up.

"And under the firmament were their wings straight, the one toward the other; every one had two, which covered on that side, their bodies. And when they went I heard the noise of their wings, like the noise of great waters."

"The Ezekiel airship to a great extent was the forerunner of the present autogiro. The double wheels, or 'wheels within wheels' were equipped with vanes that gave them lifting power. They were geared to the engine. Theoretically, the wheels were to lift the machine off the ground and the wings were to serve as gliders. The wheels, as I remember, were between five and six feet in height. The machine itself was about 18 feet wide and 25 feet long," Lockett explained.

His unswerving belief in the biblical prophecy gave the Reverend Mr. Cannon confidence. He was well past middle age when he started his venture, but he had a large following and the respect of his community. Thus he had no difficulty in forming the, Ezekiel Airship Manufacturing company. J. J. Tapp agreed to serve as president; P. W. Thorsell, a Pittsburg foundry man, was chosen vice-president; W. C. Hargrove, secretary; and A. J. Askew, treasurer. The board of directors was composed of R. H. Heath, P. W. Tapp, B. Cannon, J. C. Bailey, R. F. Lewis, S. D. Snodgrass and C. A. Dixon.

The second floor of the newly-erected Pittsburg Foundry and Machine company was turned over to the airship company. Although outside aid was called for occasionally, Cannon and Lockett did most of the actual work. Lockett is now a Pittsburg contractor. One of the heaviest stockholders was Vice-President Thorsell who still is an executive of the foundry where the airship was built. He owned $13,000 worth of shares.

"If it hadn't been for my confidence in the success of the venture," Thorsell says, "I could have made a small fortune out of my stock.

"At one time the shares were in great demand but the stockholders wouldn't turn loose of them. We all expected to be rich. I can recall on one occasion a prospective investor wanted to buy me out and offered me four to one for my stock. Even a handful of crisp yellow currency of large denomination failed to win me over."

The public's reaction is reflected in a newspaper story published in the Pittsburg *Gazette* on May 17, 1901, when excitement over the new airship company was high. The news story read:

"The progress on the work on the airship is being watched with great interest and is the main topic of conversation on the streets. Large numbers of people go down to the machine shops daily to view the machine. The stockholders have great confidence in the machine and its inventor, as is shown by the phenomenal rise of stock in the company. Anyhow, if Ezekiel's airship flies, Bradstreet and Dun's will contain the names of more Pittsburgers than usual."

But no attempt was ever made to fly the machine. After the initial flurry of excitement died down and the demand for stock sagged investors began to

(*Continued on page* 84)

New Instrument

THE latest Kollsman instrument is a completely new design in accelerometers. This instrument should be of great value both to maintenance men concerned with the flight conditions encountered by the airplane, and to the pilots concerned with passenger comfort.

The accelerometer is of importance to the maintenance man since he will know the exact stress to which the plane was subjected and will be able to adjust his inspection routine accordingly. Or the maximum flight stress in flight may be noted by the pilot, and the pointer reset to zero to obtain the maximum stress in landing. This will inform the maintenance man whether or not the landing gear will require a more rigid inspection.

Passenger comfort need no longer be left to the unaided judgment of the pilot. The air may feel comfortable to the man flying the plane, but to a passenger it may be uncomfortable. With the accelerometer measuring the air conditions, the pilot knows definitely whether or not the air is too rough for passenger comfort.

It is claimed that the instrument is of such a rugged construction that errors will not be encountered due to extreme shocks, and that excessive vibration will not throw the instrument out of calibration. It is also unnecessary to lock the mechanism in transportation or in storing. The design is such that there is no error in indication due to accelerations in a sidewise direction.

The maximum stress value is shown by one of the two pointers on the instrument, while the other indicates continuously. The maximum pointer may be reset by turning the small knob at the bottom of the dial.

Watch the Wind!

AERO Insurance Underwriters recently sent their inspectors a bulletin on the handling of light airplanes in heavy winds. The gist of the information is as follows:

1. Check the wind forecasts before attempting any cross-country trips. "Look before you leap."

2. Do not operate if wind conditions are very gusty or if the wind is near or greater than 20 m.p.h. Get your ship under cover when you see a thunderhead approaching.

3. If caught in a bad wind, land the airplane a little faster than normal. Keep your tail up as long as possible.

4. Wait for help to roll the airplane into the hangar if taxiing is difficult.

5. Help keep insurance rates down by operating airplanes within their limitations.

It would be wise for a novice pilot to practice wheel landings with an instructor so when caught under dangerous wind conditions he will be able to handle his ship with greater confidence.

Miss Gibson is learning instrument work from Max Constant.

AMAZING MISS

by SELBY CALKINS

Not many girls would have the daring to start their own flying company. But Inez Gibson takes such things in her stride, despite competition.

SO you think that running a "start any time, go anywhere" airplane charter business is a man's game?

Perhaps it is. Certainly it is one branch of aviation that has sent more hopeful pilot-business men to the cleaners than any other. Yes, strictly a man's game—unless a young, pretty woman should courageously roll up her sleeves and set out to prove the contrary.

We give you Inez Gibson.

Better yet, walk into the offices of the Union Air Service in the administration building of the Union Air Terminal at Burbank, Los Angeles' airline terminus. Ask the attractive, auburn-haired girl at the desk for the boss.

"I'm Miss Gibson," she'll say. "Where do you want to go?"

Be careful how you answer. If you should say "Wichita," for instance, she'd calmly ask where your bags were, reach into a bulging filing cabinet for a sheaf of maps and propel you by the elbow to an ever-ready 320 h.p. Waco just outside the fence.

It would be as simple as that. Charter jaunts to far places are her business. Her pilots are always ready and the Waco's gas tanks are always full.

Not so long ago she tried acting and played a few roles. She was a competitive swimmer of no mean ability. Dining, dancing and the gay places were fun. A pilot to her was a dashing sort of gent with wings on his shirt and an aura of masculine glamor about his head.

Today aviation is her business. Stunting her Ryan and preparing for the next Bendix race are fun. A pilot is someone to be quizzed—especially if he is a prospective Union Air Service employee—on hours of night flying, ratings, instrument training, avigation, radio, meteorology and kindred technicalities.

If you're Mr. Average Man and prejudiced against flying with a woman at the controls, calm your fears—Miss Gibson won't be your pilot. She is a competent, licensed commercial pilot but quite sensibly bows to prejudice and turns it to her advantage.

"People still have their doubts about women pilots," she admits. "The answer is to give them a man pilot and avoid that much sales resistance, isn't it?"

Such direct thinking augurs well for Miss Gibson's future in the highly competitive branch of aviation she has chosen for her own. Besides, calm straight-away flying isn't her dish. It interferes with her aerobatics and preparations for the Bendix Trophy race.

Inez Gibson's story is a short one, which makes it the more amazing. She took her first flying lesson three years ago from the late veteran Joe Lewis. The innoculation "took" and she set out, under Lewis' tutelage, to win first a private license then a commercial certificate followed by training in heavier,

Miss Gibson is a capable pilot and currently is training for the Bendix derby.

Miss Gibson discusses the route of a charter trip with Fred Steves, one of her pilots. She believes that successfully completed trips establish a profitable reputation.

faster ships than one out of a hundred sportsman pilots attempt to master. She chalked up one cross-country trip in a leisurely jaunt to the National Air Races in Cleveland and a second to ferry a Fairchild to the Pacific Coast from Maryland.

She still regarded flying as a fine sport until one Sunday last October she read in her morning paper of the death of Joe Lewis in a crash in northern California. The next day she learned that the Lewis Air Service was about to be sold piecemeal by unsympathetic administrators.

The *next* day she owned four airplanes, an operating franchise at the Union Air Terminal, absolutely no experience and the firm name of Union Air Services.

"Whether I last as a business woman, especially in this business, remains to be seen," says Inez candidly. Equally candid are her competitors—and they admit that she's giving them a whale of a run for their money!

Her first decision won sage nods of approval even from the doubters: she determined to hire the best pilots she could and foreswore any suggestion that she should fly any commercial trip herself—even a sight-seeing hop—though she is fully qualified. Instead she intends to devote her time to management . . . when not planning adventures that will advertise her business at the same time she broadens her own experience.

Currently it is the 1939 Bendix dash she eats, sleeps and dreams. She has bought and soloed one "mystery" ship—a cleaned-up, hopped-up version of an Army design—and has her eye on another that may prove even faster.

Inez Gibson isn't fooling about the race. She is studying avigation and instrument flying with Max Constant, one of the best in that field. She is polishing up her air work by studying aerobatics with Tex Rankin, king of the precision flyers. She wisely and calmly is preparing for any contingency on the gruelling flight. Inez intends to fly solo and to be prepared for the job. She is quite certain that whichever ship she flies, it will be the surprise of the race.

Just as matter-of-fact is her approach to the business of making her charter and student instruction service pay for her equipment (including a new Beechcraft soon to go on the line with the Waco) and the quiet little home she has in Burbank.

Shrewd Miss Gibson observed that completed flights are what establish a reputation and thus bring in the cash. Her Waco is therefore fully equipped with instruments, two-way radio, landing lights, flares and other facilities for safe, careful transport night or day, good weather or bad. Passengers are insured on every flight and her planes are covered for property damage and personal liability.

"Good business," she calls it. That's her whole credo. It is good business that her office at the airport and her home miles away are on the same telephone line. It is good business that her student instructor, soft-spoken Harry Marshall, is given a trim Ryan for primary work and access to the other ships for advanced training. It is also good business that her other pilot is trained in flying cross-country off as well as on the airways and that either of the flying men is capable of taking the other's assignment. They know their jobs and, in addition, have the judgment that is required of them as Miss Gibson's business representative once a flight leaves the airport.

Finding—and keeping—such pilots is one long "Ouch!" to Inez. She gets 'em and the airlines steal 'em! (Just as this was being written she had turned

(*Continued on page* 80)

The Thunderbird
by Edward Green

MOIS MIRASTY, a huge Cree Indian, knew little of fatal dates, but on the 13th of August he did know that he and two other Indians must freight trading post supplies to the Pelican Narrows post. The 13th meant little to him and his partners as they loaded their canoes and started the outboard motors.

Soon, Mois thought, they would reach the south end of Reindeer Lake but before they arrived there they would have to travel through the treacherous fast water of the Whitesand Rapids. Even then, they were nearing Devil Rapids where the wicked white water leaped up to swamp and wreck canoes not handled by strong arms and powerful motors.

As they neared the swift rapids on the Whitesand, the buzzing drone of a huge motor rose to a roar. Looking up, the three men saw a big Fairchild monoplane slipping across the northern sky at more than a hundred miles an hour. The ship was alone in the heavens.

What a wonderful thing, Mois thought, if they were doing their freighting like the white man. They too would have a "thunderbird" and be able to hurl tons of supplies across that rugged country without trouble. The only comfort they had now was the sharp bark of the tiny outboard motor as it thrust the heavily laden canoe nearer to the rapids.

The white man with his "thunderbird" thought little of either rapids or rocks. He simply loaded his duffle aboard one of those wondrous winged canoes and, caring little for wind or weather, shot across the skies like the flaming aurora-borealis.

Mois looked at his two companions, Tommy Morin and his son Johnny. They were expert canoemen but the frail craft was well loaded and low in the water. Those rapids were fast and it was certainly a good thing that they possessed a strong little engine to help them through the swift spuming waters.

Twenty yards from the Whitesand, Mois, clutched the steering handle of the outboard. His keen black eyes watched the black rocks rearing their ugly heads out of the swirling river. It would take all his skill to guide his craft through, for combined with the speed of the canoe the rushing current was taking them on at a fast clip.

Curling little combers of hungry water licked up the gunwales and the flying spray wetted the faces of the three Crees. Suddenly a wicked looking rock showed for an instant and was again lost in the foam. Mois thrust his tiller handle to avoid that rock and then—his engine failed.

Robbed of steerage way, the canoe was seized by the savage water and hurled around like a cork. Narrowly missing a rock it hurtled down the rapids toward the faster water. Paddles were useless, even if they had been available and Mois realized with mounting terror just what lay ahead.

Gathering still more speed, the canoe,

(*Continued on page* 64)

THE Man UNDER THE Hood

MOST secret of all new Air Corps battleplanes is the **Consolidated** four-engined B-24 bomber . . . it's supposedly the next step ahead of the Boeing B-17s . . . it's a landplane with a tricycle landing gear, a particularly excellent high speed and range—and a cruising speed said to be in the vicinity of 200 m.p.h. . . . the company has a contract to build five, we hear . . . for a total of $2,880,000 . . . this ship may be flying by the time you read this . . . surprise in all this is the fact that **Consolidated** has been concentrating for the last five years on Navy business.

* * *

No matter what anyone tells you, the **Lindberghs** are home to stay . . . he already has accepted active duty with the Air Corps and Mrs. Lindbergh returned soon afterward with their two children . . . intimates, with whom Colonel Lindbergh has visited recently, are positive he's home permanently. . . .

Lindbergh

* * *

Butter is so terribly scarce in Germany that Nazi airline pilots who fly into other bordering countries smuggle in as much as they can carry without being seen . . . it works something like this: the visiting pilot buys several huge sandwiches in Holland, France, England or Switzerland—wherever butter is obtainable . . . the sandwiches ostensibly are to be his lunch during the return flight to Germany . . . however, these sandwiches consist of sometimes an inch-thick layer of butter and the tiniest amount of meat and bread . . . the pilots take the sandwiches home to their hungrily waiting families . . . there's the story, too, of a group of German army pilots who flew a flight of brand new Junkers bombers to **Jugoslavia** to "impress" the latter . . . while walking past a **Belgrade** delicatessen, the pilots (who are among the "highest-paid" professional men in their country) spotted a large quantity of butter and sausages in the window . . . they asked their **Jugoslavian** escorts whether those "delicacies" actually were for sale . . . when told they were, the pilots trooped into the store with shining eyes, bought every scrap of butter and sausage they could get and smuggled the booty back to their families in Germany by hiding it in their bombers' ammunition and bomb racks. . . .

* * *

Speaking of the Germans, it is estimated that 1,200 pilots in their air force were killed in accidents during 1937 . . . that figure since has been cut down to an annual average of 600 . . . this toll is due almost entirely to efforts to rush through every young fledgling as fast as possible. . . .

* * *

Northwest Airlines has quietly sought and obtained a loan from the Reconstruction Finance Corporation amounting to $480,000 . . . the money's for six Douglas DC-3's ($120,000 each), six engines at $12,300 each and spare parts, propellers and radio equipment amounting to $64,100 . . . **Northwest** has agreed to repay the loan at a rate of $12,400 monthly.

* * *

A few persons were treated to an unusual sight at **Clover Field** near Los Angeles the other day . . . the ship was a tiny new high-speed fighter . . . it was equipped with those built-in slots first used by **Lockheed** . . . to test the slots' capabilities, the factory pilot flew the ship across the field several times in a nose-high, stalled position . . . the ship was so low the tail wheel literally dragged along the airport . . . yet, the pilot had complete control of the ship at 40 m.p.h.! . . . to prove that the slots were all they're said to be and more, the pilot kept rocking his wings all the way. . . .

* * *

Promotion by **President Roosevelt** of **Capt. John H. Towers** to be chief of the Bureau of Aeronautics with rank of rear admiral is a none-too-subtle thwack at the high-handed tactics of the last **Navy** selection board which decided what captains should assume flag rank . . . Captain Towers, one of the first three officers assigned to the **Navy's** embryo flying branch in 1911 and who today is the only one of the trio in active service and is internationally known as the United States' No. 1 Navy aviator, was "passed over" by the board . . . this, and other astonishing omissions by the board have, according to Washington whispers, acted as a boomerang to the three-striper who sat at the head of the table when **Captain Towers'** name was tossed in the waste basket—none other than **Admiral Claude C. Bloch**, Fleet commander-in-chief . . . he was slated to be the next Chief of Naval Operations—every **Navy** officer's goal—but **President Roosevelt**, who makes this choice personally, is said to have been so displeased with **Admiral Bloch's** conduct of the Selection Board that he named **Rear Admiral Harold R. Stark** instead . . . and **Capt. Leigh Noyes**, chief of staff to **Vice-Adm. Ernest J. King**, Aircraft Battle Force commander, is leaving aviation for good, 'tis said . . . he's one of those older officers who entered aviation late in his career, knows far less about flying than most of his subordinates yet, because of his rank was able to give them orders . . . he'll be through with flying as the next chief of Naval Communications. . . .

Towers

* * *

One of the major airlines had a bad crack-up in 1935 which resulted in that company being fined $500 each on several counts of alleged violation of the Government regulations dealing with safe airline operations . . . the airline refused to pay the fines, largely because such payment would automatically have been an admission of guilt . . . the case dragged out, year after year, until just a few weeks ago . . . the airline involved quietly settled for $1,600. . . .

* * *

They say **Jacqueline Cochran** has been trying to get an okay from the Army to buy a Curtiss P-36 . . . she's supposed to be wanting to enter it in the Bendix race this year . . . she told friends at Palm Springs, California, recently that she'd not enter the 1939 Bendix unless she could be assured of having a plane at least as fast as any other ship in that competition . . . she says she'll be out to win or she'll not be flying at all.

Cochran

* * *

All the hullabaloo about the transatlantic is amusing . . . the CAA had been pushed around by the Post Office Department because it hadn't fixed air mail rates till recently . . . and **Pan American** is moaning because the CAA's delay in handing out a certificate of convenience and necessity is going to force postponement of passenger-carrying trips until about the end of June . . . **Pan American Airways** was slated to fly a trip with mail and express leaving Baltimore on May 20—12th anniversary of the day Lindbergh took off for Paris . . . they had to because Jim Farley already had told the country's stamp collectors to have their mail ready on the 16th to catch that first trip four days later.

Lindbergh was rumored to have turned down **Pan American's** invitation to be aboard that trip as a member of the crew . . . it's said he refused to go, saying: "I don't like to be just a passenger—I like to do my own flying. Besides I'm not qualified for that type of flying."

* * *

That talk about **United Air Lines'** absorption of **Western Air Express** still persists, despite vehement denials by United's publicity department . . . if the

companies aren't actually one, they're within a tooth's-skin of it . . . they're each using identical equipment. . . . United's copyrighted trade-mark for its Douglases is "Mainliner" . . . Western Air uses the same name on its ships . . . pilots and stewardesses uniforms on both lines are almost identical . . . Western Air even uses United's red, white and blue shield insignia on the nose of its "Mainliners" . . . the wording is different, though . . . but United insists that the two companies have not merged and don't intend to. . . .

* * *

In addition to those B-24 bombers mentioned at the start of this column, the Army's also getting quite a batch ($12,872,398 worth) of **Curtiss** P-40's, the big Allison-engined version of the P-36 . . . **Lockheed,** meanwhile, has a contract for $2,180,728 worth of twin-engined (Allison again) tricycle-geared fighters like that which cracked up near Mitchel Field, New York, at the end of a sizzling cross-country flight . . . **Larry Bell** also is in on the deal with $1,073,445 worth of XP-39 single-seater tricycle-geared fighters on order . . . also, by the time you read this, **Martin, Stearman** and possibly **North American** (either one of them alone, or split among all) will have been given orders for about $19,000,000 worth of attack bombers. . . .

* * *

The big **Allison** engine we mentioned months ago as developing 2,000 h.p. is a 24-cylinder "X" job . . . we're told that, in effect, they took two of the V-12s that turn up to 1,200 h.p. for take-off and put them together, one upright, one inverted . . . the big **Packard** "X" engine of about 1922 was the last of its kind to fly in the United States . . . it was flown at Wright Field in a Le Pere biplane . . . the **Packard** was too big and weighed too much for its power.

* * *

From Wright Field has gone a call to manufacturers to design fighters capable of 500 m.p.h. . . . that speed is needed for 1942 . . . the **Army** believes German planes will hit the 500 m.p.h. mark before the end of 1939 . . . the present record is 463 m.p.h. in a Messerschmitt with a 2,000 h.p. Daimler-Benz engine . . . we won't need such speeds because no plane in this speed class could be brought into combat against us from any aircraft carrier or expeditionary force. . . .

* * *

Here's this rumor again . . . it's been so persistent—but at the same time sketchy—that we had better go on record with it, just in case it turns out to be true . . . Britain's Air Ministry is said to be considering the purchase of at least one **Boeing B-17** four-engined bomber—an export version, that is . . . also, the story goes, if and when the purchase goes through, the ship may be flown across the Atlantic for delivery . . . which might give the dictators something to think about . . . especially considering the fact that the B-17 design basically is quite a few years old. . . .

* * *

Expect to see the **Pitcairn Autogiro Company,** long dormant, blossom out this summer with an Americanized version of the Focke-Wolf helicopter . . . the **Pitcairn** company is supposed to have purchased the rights to this helicopter, best of all the hundreds of types of true vertical-rising and hovering plane that have been designed . . . **Pitcairn** backers believe they will have the real answer to utility, efficiency and safety in airplanes in their helicopter. . . .

* * *

What's this about one of the country's leading west coast aircraft manufacturers planning to set up a factory near Rantoul, Ill.? . . . might be logical, in view of the War Department's recent "suggestion" to all major air-armament manufacturers that they move their extremely vulnerable Pacific- and Atlantic-coast plants inland . . . another rumor along those lines is that one of the largest east coast engine manufacturing firms is supposedly considering the erection of a $4,000,000 plant near Chicago. . . .

" . . . One map shows where our planes go, the other shows where our planes have been . . . "

* * *

The British are reputedly interested in an American version of geodetic construction—the **Barkley-Grow** twin-engined all-metal transport . . . the British were the first to apply this basket-weave type of construction successfully to standard aircraft . . . the **Barkley-Grow** has this peculiar but excellent construction in its wing only . . . we hear now the British are considering the purchase of some of these ships, possibly through the Canadian Car and Foundry company which has the Canadian license for the sale of the American ship. . . .

* * *

A **French** aviation mission has been scouting around over here again lately . . . from California comes the report that they may be interested in a military version of the **DC-4** . . . which would make a whopping bomber or cargo ship . . . meanwhile, the French are known to be interested in that rocketing **Curtiss** interceptor fighter developed by that company's St. Louis factory. . . .

* * *

Have you noticed the complete absence of statements or articles by any of the men who accompanied **Howard Hughes** on his round-the-world flight? . . . there's a story behind that silence . . . one of the crew members, seeing possibilities for a good deal of publicity for himself after the flight's end, made a few remarks in anticipation of his glory-to-be — and called his aspirations directly to the attention of the millionaire pilot . . . so **Hughes** got together with the flight's press agent with the result that each member of the crew had to agree to neither say nor write anything that would extol that man individually . . . thus depriving the lesser-known flyers of any additional glory and forcing all attention to be directed solely at **Howard Hughes** . . . so far as we know, that "agreement" still exists. . . .

* * *

A southern airline official is said to have started an organization that, among other things, extends several hitherto unobtainable insurance benefits to airline pilots who join up . . . which should—and unquestionably does —give the **Air Line Pilots' Association** something to think about. . . .

* * *

A **Sperry** engineer has devised and completed a new gyro-pilot said to be far more sensitive than the existing design currently in use on practically every airline in the world as well as by many military services. . . the **Sperry** engineer has installed the first completed unit on his private airplane. . . .

* * *

Odds and Ends . . . Earl Ortman, famed racing pilot, now is a Canadian Colonial (New York-Montreal) Airways co-pilot . . . that twin-engined **Douglas** attack-bomber that crashed with the Frenchman aboard was clocked at 380 m.p.h. during tests . . . **Lockheed's** novel project, the *Vega* (powered with the Unitwin engine) can be had by private owners for $27,500 per copy . . . as an airliner the ship's worth $30,000 each—and Mid Continent Airlines (Minneapolis-Tulsa) already has ordered one . . . our private nomination for the most popular big airliner coming up: the **Douglas DC-5.** . . .

END

HE DESIGNED A TIGER

Robert J. Woods

by GEORGE R. REISS

Robert Woods has a few ideas the aviation industry might well use. His version of a formidable warplane has had the Air Corps in a dither for many months.

INTRODUCING the man who designed America's most vicious, dangerous fighting airplane, The Tiger of The Sky—Robert J. Woods.

He's the fellow who conceived The Tiger in his own brain, who made mental pictures of it, who laid it out in all its intricate and intimate details on paper, who conducted the exhausting and exhaustive wind tunnel tests and then directed its building, part by part, with loving, expert care.

If you've heard too little yet of that snarling, snapping Tiger that has the aviation world watching in wonderment —the Bell *Airacuda*—you will soon hear more. For this vicious cannon-carrying, two-engined, two-seater fighter that can outfly and outfight the swiftest single-seater fighters, has the war-mad dictators of the war-mad countries worrying today.

Robert J. Woods, its designer, serves as the shining example to prove that Old Dame Opportnity still knocks—and you'll hear her, provided you've got your ear tuned and sharpened to recognize her knock. Woods, only 34 years old and not too long out of aeronautical school, is chief engineer of the Bell Aircraft Corporation of Buffalo, N. Y., and as such, today one of the world's outstanding aircraft designers. He might justly be dubbed the Horatio Alger of the aircraft designing world. For he has climbed the ladder of success, rung by rung, hoisting himself up each successive step by his own sheer effort and initiative.

Woods is a big, serious-minded 200-pound six-footer, intensely interested in every tiny detail as well as in the final result. He's typical of that unsung, little-honored fraternity which worked so long and late over the drafting boards in the enigneering departments of the aircraft factories, worrying little about much credit and getting mighty little of it, too—but so meticulous and accurate in their work so that they can tell exactly what their latest creations will achieve in every detail months before the test pilots get at them.

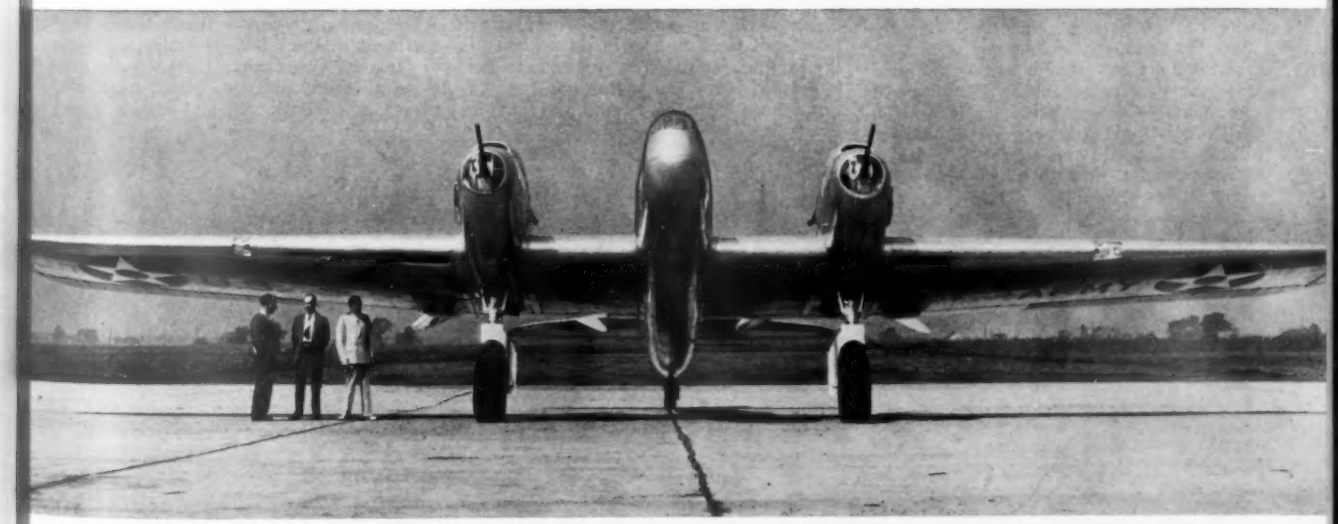
Bob Woods is extremely proud of his Tiger, so proud that his eyes light up and gleam affectionately when one speaks of her.

"The finest fighter of the air today," he comments enthusiastically. But he brushes credit aside laconically.

"It's nothing," he says modestly. "She's a collection of the best ideas of a group of aeronautical engineers. I've merely co-ordinated these, taking the best features of each of them to complete the design."

Bob Woods' start was a regular Horatio Alger start. Born of a poor family in Youngstown, Ohio, June 21, 1904, his aptitude for putting his ideas on paper were discovered early—in fact, by the time he walked. His mother discovered she could keep him quiet by giving him a paper and pencil and permitting him to make sketches. As he grew older, his sketches improved. Chiefly they were sketches of automobile, marvelously accurate in detail. But never airplanes. He wasn't interested.

Then, when Bob was 14, his father died in 1918. Three years later, his mother died, leaving him orphaned at 17. He struggled through high school, then worked in the engineering department of the Truscon Steel Company, a large



The Bell "Airacuda" is Robert Woods' dream-plane. He did so well the Air Corps has ordered 13 of them.

builder specializing in airplane hangars.

At night, he attended college classes.

Finally, his parents' estate was settled. Young Woods was left with $1,200 cash and an empty suitcase—nothing else, but a yen for a college education. Woods looked over the field of colleges and finally hit upon the University of Michigan, combining a mechanical engineering and aeronautical engineering course, although his interest in aircraft design was casual, very casual. He had never flown, never had any particular desire to fly or to design aircraft. In fact, he planned to go into mechanical engineering after college—that is, until he had his run-in with the professor in charge of the university's very excellent aeronautical department. This proves that Woods is a very stubborn, very persistent lad.

"Woods," advised the kindly professor, drawing him aside one day at the end of his second year in college, "you'd better give up your aeronautical engineering and specialize in something else."

"Why?" sputtered the young student belligerently.

"Oh," explained the professor, "you're not cut out to be an aeronautical engineer. You'll just never make one. It's not in you. You haven't the proper aptitude."

"I'll make an aeronautical engineer," spat young Woods, gritting his teeth fiercely. "I'll show you." And he has.

"I was pretty mad about that," laughs Woods today, "as a matter of fact I still am. But I know that professor did me a good turn."

For that incident probably changed the course of his life from just another mechanical engineer into the outstanding aeronautical engineer who designed one of America's really outstanding airplanes. But it was a hard struggle. Parentless and friendless and with nothing but the $1,200 to start with, Woods had a hard struggle.

He had to pay his own tuition and board. The $1,200 didn't go very far. He accomplished the almost superhuman feat by working in the steel company engineering department summers, waiting on tables, firing furnaces, running errands outside of school hours.

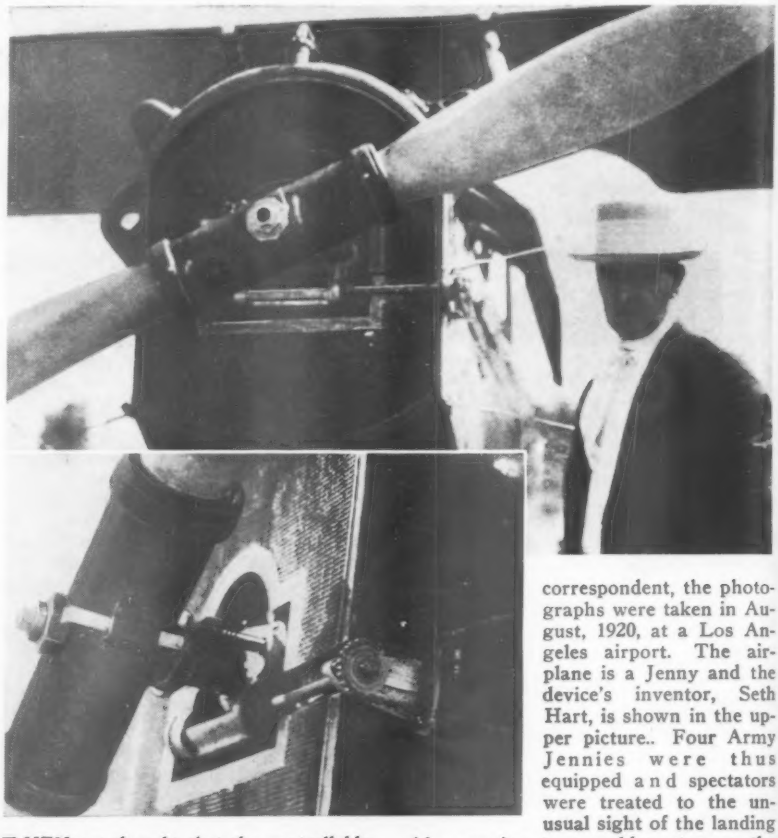
When he left the university, Woods became a junior aeronautical engineer in the variable density wind tunnel section of the National Advisory Committee for Aeronautics at Langley Field, Virginia. That added to his wealth of knowledge about aircraft design.

Then, for a year, he was assistant chief engineer of the Towle Aircraft Company of Detroit, designing a small, two-motored all-metal amphibian airplane. It was not a spectacular success. Then, for two and a half years, he was employed by the Detroit Aircraft Corporation, of Detroit, as project engineer first on a small flying boat design and then on an experimental Army pursuit airplane designated as the XP-900.

Later, he went to the Lockheed Aircraft Company, Burbank, California, as project engineer on Army Air Corps pursuit and attack airplane designs designated as the Y1P-24 and YA-9 airplanes,

(*Continued on page 72*)

Controllable Propeller: 1920



EVEN *we* thought that the controllable-pitch propeller was a comparatively modern invention. That is, until the above photographs arrived from California. According to POPULAR AVIATION'S correspondent, the photographs were taken in August, 1920, at a Los Angeles airport. The airplane is a Jenny and the device's inventor, Seth Hart, is shown in the upper picture.. Four Army Jennies were thus equipped and spectators were treated to the unusual sight of the landing ships coming to a sudden stop as the pilots reversed the propellers' pitch. The close-up photograph shows the bicycle chain and wires with which the pilot operated the mechanism from the cockpit.

A Modern Jenny

THIS is a sight for the sore eyes of some veteran airmen who spent many months of their careers in the cockpit of the famous Jenny. The photograph below is a Jenny, all right, but the old girl's been entirely rebuilt and put in flying condition. The job was done for a Hollywood studio by the aviation department of the Chaffey Junior College of Ontario, California. In that school's shops all spars, ribs, struts, etc., were replaced, as were controls and wing braces.

10 GOAL PILOT

by DONALD FROST

Naturally, Tommy Hitchcock is best known for his prowess on a polo pony. But his steed once was a war-flying pursuit plane and, today, flying is one of his favorite hobbies.

A TRIM, little Fairchild "24" on floats streaked down Long Island sound, hovered for a moment over the tip of Manhattan, then circled for a landing. A moment later she eased into the East River at the foot of Wall Street and an electrically operated floating ramp came down. A tall, athletic man stepped out of the plane, spoke a few words to the pilot and then struck out on foot across the financial district to an impressive, solemn building occupied by the old and conservative banking house of Lehman Brothers. He took the elevator to the third floor, saluted the boy on duty at a desk in the reception corridor and disappeared behind huge double-doors into his office.

Twenty minutes before, that man had stepped out of the front door of his home at Sands Point, about 20 miles out of New York City on Long Island and an hour from New York by automobile. He is one of New York's growing number of commuters-by-air and, unlike many of them he flies his own plane. A pilot accompanies him. He returns the plane to Long Island so the rest of the family can use it.

Twenty-two years ago that man was no air-commuter to business, but the youngest member of that daredevil band of young Americans who went to France before the United States entered the World War and flew with the immortal Lafayette Escadrille. He is Thomas J. Hitchcock, Jr., banker and financier, but better known to flyers and sportsmen as Tommy Hitchcock. He is a ten-goal polo player and one of the longest, hardest-hitting, hell-for-leather riders who ever mounted a polo pony to strike terror into the hearts of his opponents and to give spectators the kind of thrills given only by a top-notcher in any sport.

Hitchcock is the last active survivor of that Golden Era of Sports which saw Jack Dempsey, Bill Tilden, Bobby Jones, Babe Ruth and Helen Wills rise to sportsdom's heights and sweep all opposition before them. No man has dominated a sport for so long as Tommy Hitchcock has dominated polo.

Hitchcock now is 39, strong, well-built, his 190 pounds comfortably knit on his five feet eleven inches. There are a few signs of grey in his brown hair. His eyes are deep blue, keen, but friendly and his manner is pleasant and gracious. As he sat talking in a reception room outside his office he gave the impression of being anything but the devil-may-care flyer and polo player. He is as matter-of-fact about his World War flying and his polo exploits as his partisans are enthusiastic in their admiration for him.

"I first went over the lines in—let's see—December, December, 1917," he said in answer to a question. "I was shot down March sixth."

That's all. Just "I was shot down March sixth." Nothing of the months before that, life in the escadrille, the patrols over the German lines. It was necessary to go elsewhere to find out

Tommy Hitchcock flies to work every day in his float-equipped Fairchild monoplane.

that he learned to fly by the dangerous expedient of teaching himself, that he twice brought down German planes, that he was decorated with the Croix de Guerre.

There was nothing about his first crack-up which came when he was en route back to his base after he had brought down his first enemy plane. He came down behind the French lines, fortunately, and was not seriously hurt. It was after he had brought down his second enemy ship that he ran into double-trouble, or perhaps it should be called triple-trouble.

He was on his way back to his base when he sighted two German ships. Two to one, but that kind of fighting was made to order for Hitchcock. Off he dashed, so intent that he failed to note the sudden appearance of a third enemy plane. There was a sting in his hip. Machine gun bullets whined through his plane. Then something went wrong with the controls. Harassed by enemy planes and struggling with a damaged ship, he somehow managed to bring her down from 1,000 meters. He was behind the German lines. Wounded as he was, there was no chance to escape and Hitchcock was captured. His captors took him to a hospital. He spent two months in hospitals before he was finally taken to a prison camp.

"I was in the hospital for two months," he said, as casually as if he were announcing he had spent two months in the country. "Then I was in a prison camp for four months. I planned to escape."

Behind this simple statement was a stark drama, a story in itself. It was a drama of life and death, of prison camps and prison hospitals, of a strange youth, wounded and a prisoner in a strange land. But whatever the story is, Tommy Hitchcock does not tell it beyond the statement that he was in the hospital for two months and in a prison camp for four months. That is something in the past and Tommy Hitchcock is not a man to dwell in the past. He is looking to the future and at the moment is particularly interested in the development of transatlantic commercial flying.

"And did you escape?" he was asked.

"Oh, yes," he replied. "There were three of us in on it, but about the time we were ready to make a break for it, we were transferred to another prison camp. The train stopped somewhere along the route. The guard was dozing. Finally he fell asleep. There was a map sticking out of his pocket and, while he slept, I slipped the map out of his pocket so we could find our way to the border. I was afraid all the time that he would wake up. He did, but we made a run for it and got away. I struck out for Switzerland."

Hitchcock discovered from his pilfered map that he was some 100 miles from the Swiss frontier. By day he hid in the woods in isolated sections of the country. By night he pushed on toward the border avoiding towns and villages and curious people. He had a small stock of food with him. It was typical of him that he prepared for this desperate adventure.

"Of course," he explained, "I traveled somewhat more than 100 miles because I had to keep off the beaten path. It took me eight nights to reach the border."

A couple of days later he was back in France. He was stricken with the flu and on his way home when the Armistice was signed."

A few days before the interview Hitchcock had taken a flight over New York City in the new super-flying boat *Yankee Clipper,* built for transatlantic traffic. He was impressed with the ease of its take-off, with its spaciousness and especially with the chart and control room and the devices which take much of the detail of flying off the pilot's mind and hands.

". . . and during tests, instead of adding tails we intend taking tails off . . ."

"A man has to be almost more than human to operate one of the great ships of today with its instrument board full of gadgets," he said. "I fly contact myself and if the weather isn't good, I just don't go.

"In the early days of aviation," he said, "we just expected the engines to fail sometimes—and they did. Now they don't. Why I heard an aviation expert say the other day that the chances of both motors failing on a two-motored ship are about one in 56 years. Engines don't fail any more. If there's trouble, it's something else."

A comparison of his flight in the *Yankee Clipper* and the crates he flew in France? There just isn't anyway to compare the two. Hitchcock's chief aviation interest at the moment is the transatlantic service and, particularly, the export trade.

"The Atlantic crossing is an amazing thing," he declared. "The possibilities are tremendous; the traffic, connecting as it does such immense centers of population serving the largest trade areas in the world."

Hitchcock said he believed there would be a tremendous mail and express service over-the-ocean. He predicted that overnight mail service to London would be commonplace.

Hitchcock explained that a shipping firm in which he is interested, the American Export Lines, plans to supplement its ship route to Mediterranean ports with an air route—watercraft traffic augmented by aircraft traffic. Preliminary plans have already been made. An experimental ship of the air has been purchased looking toward express transportation by air to European trade centers.

Hitchcock believes shipment of gold by plane will be a considerable item and that such transportation will facilitate international banking and trade and stimulate it to a degree unknown now.

Hitchcock does not share the fear expressed by some people that long-range flying boats have put us too close to Europe and its troubles.

"We have no need to be concerned," he said. "It is better from a national defense standpoint that we should take the lead in the development of long-range craft instead of standing by and watching others take over. Besides, we have plenty of planes we can send out to meet any air visitor from Europe.

"And another thing you must remember," he continued, "The wind generally blows from west to east over the Atlantic and planes flying westward to the United States have a little problem there and a natural deterrent to contend with."

Hitchcock's summer home on Long Island is about two miles from the Port Washington airport where the Bermuda and transatlantic planes dock and take-off. "My plane is a four-place job," Hitchcock said, "but it looks like I would have to give up the space of one seat for a radio."

Then he told about an interesting situation. Out at North Beach, about 25 minutes by car from the Grand Central area in Manhattan, the City of New York is constructing a great airport with facilities for land and sea planes. The traffic at the new airport will be almost comparable to the motor traffic in Times Square. Planes of all sizes and description will be landing and taking-off all day and far into the night—and therein lies the explanation for the loss of that one seat.

The aircommuters route from Long Island lies directly over the new North Beach airport. That airport traffic is no place for a man who is merely flying to business. The field controls the air for

(*Continued on page* 86)

Personalities

Hugh W. Stephens has been appointed public relations head of Northwest Airlines.

Edmund T. Allen, famed test pilot, has joined the staff of the Boeing company.

William P. Sloan has been named a flight instructor at the Ryan school, San Diego.

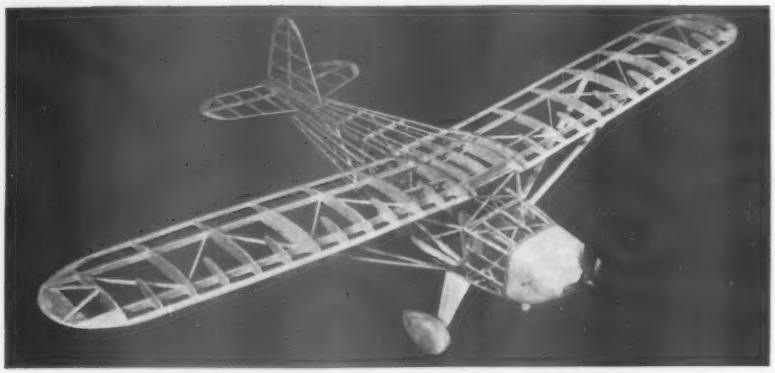
These Braniff Airways hostesses traveled their airline, from Chicago to Texas, distributing rare Texas flowers.

Teddy Lange, 18 months old, was caught by a cameraman on his first plane visit.

Mrs. T. E. Braniff (right), wife of the airline head, caught this 4-foot tarpon.

The Flying Hutchinsons are off again, this time on a round-the-world flight.

Jacqueline Feeney of Pueblo, Colo., is eight, flies regularly with her father.



A particularly sturdy construction job is evidenced in this photograph of the model before covering. The wheel pants should be removed to obtain the best performance.

THIS MONTH'S MODEL

by PAUL W. LINDBERG

Model Editor and Designer

WE really have a scoop for model builders this month—the latest in sportplanes. Its beautiful appearance plus striking performance will thrill the model builder. The Stinson people have been kind enough to forward us blueprints and specifications on this quick little flyer and we have developed these plans into a flying gas model. You will find them easy to follow.

This particular ship is colored blue with yellow trim. For best performance remove wheel pants, as they will only be damaged upon landing. By increasing the plans four times shown here in the magazine you will have the correct size model built by our laboratory.

By carefully studying details on the motor mount it will be noted that the complete assembly, including the motor, may be removed easily from the nose by a simple method (see plan). All the latest improvements have been built into this model so as to assure you that when completed, this model is one that you will be well proud of.

Construction of Fuselage

Construction of the fuselage is simple if careful steps are taken. We advise placing a piece of waxed paper on the plan to prevent the parts from sticking to it. Make the two sides of the fuselage first. After they have dried thoroughly, place all cross members in place correspondingly. After all formers have been carefully cut to shape, they may next be attached to the fuselage. Run the stringers over these, carefully cementing them at their proper junctions. Do not omit the cabin door, as this is a means of inspecting and installing new batteries in the model.

Construction of Landing Gear

The landing gear is fairly easy to construct and should be studied carefully on the plan before going any further. Properly cement and bind all joints plus the addition of stress members shown on plan. The engine cowl is carved from balsa to as thin a shell as possible. A good finish is best obtained by adding several coats of clear dope with a light sanding between each coat.

Tail surfaces are of the flat section type. Construct these upon a flat surface so as to prevent any warping. The wings should be carefully made, making sure all compression members as well as cross bases are placed in their proper positions, as this will prevent warping of the wing when it is covered with bamboo paper.

Covering the Model

In covering the model, use a good grade of bamboo paper as this will give more lasting service than any other known type of covering. In attaching the paper to the framework it is necessary to use very heavy dope or the paper will not stick to the framework. Ordinary airplane cement thinned out about 25 per cent is an excellent adhesive. It is best to cover the wings and tail surfaces separate from fuselage. Spray these with a thin coat of water and pin down upon a flat surface until they are dry. By applying water to the various parts they will become taut after the water has evaporated from surface.

Finishing Details

All details such as installation of motor, wiring, lettering, etc., are explained in the plans and pictures.

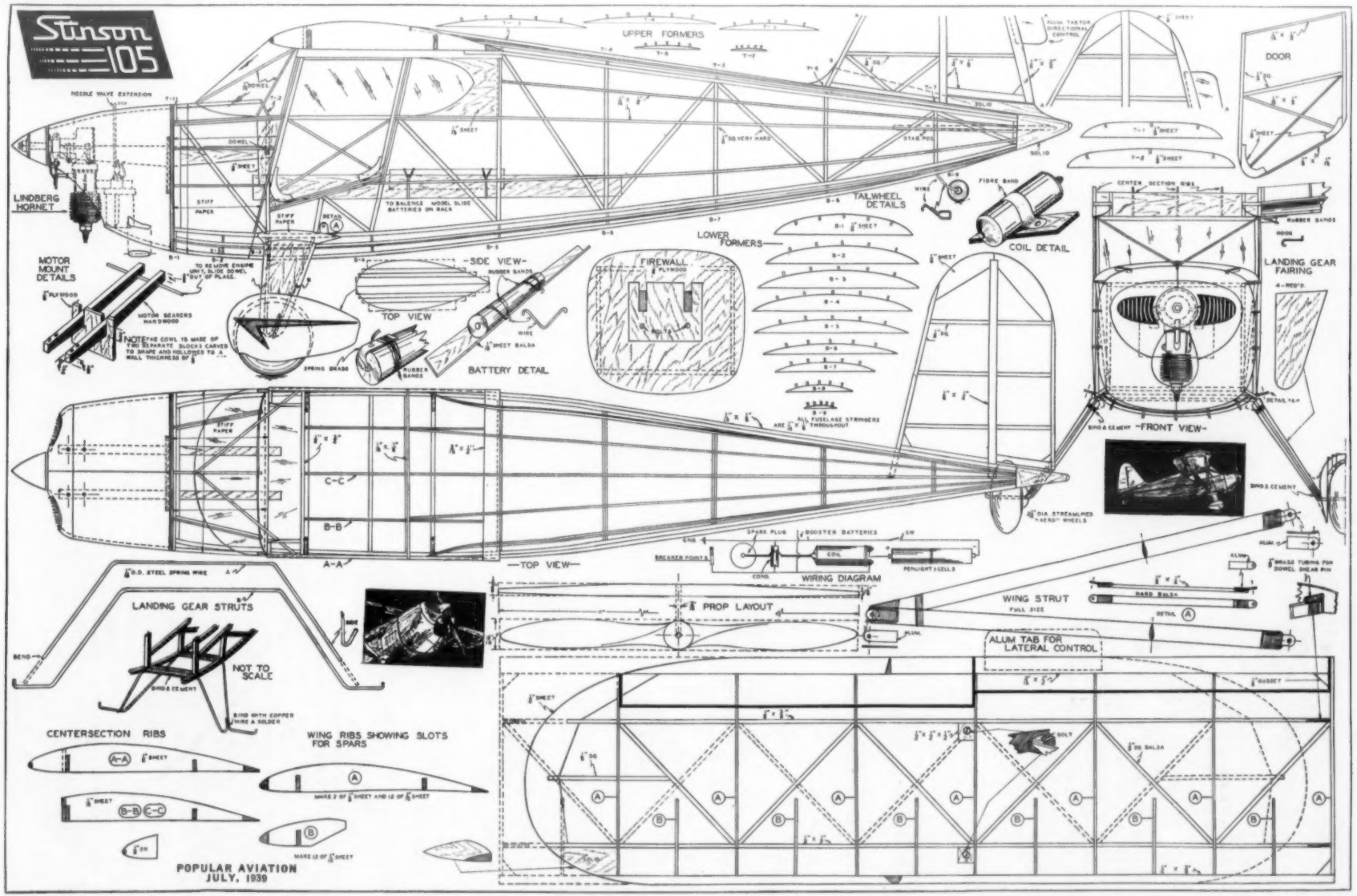
In launching the model it is always important to test-glide it first. Make sure that it glides to the ground on an even downward keel with no stalling effects. Aluminum tabs in the rudder and left wing are for lateral directional control.

Be sure the model is fairly loaded while testing for the proper gliding angle.

The finished model is well worthy of the name it bears. Particularly excellent results have been gotten in streamlining the design. The ship is blue with yellow trim.

Service!

HERE'S a sample of airline service. A man's hat, initials R. R. B., was left in a restaurant at Cleveland recently. The checkroom girl said she had heard the man say he arrived in Cleveland by plane from Chicago. The restaurant called United Air Lines, who said that the hat probably belonged to R. R. Brown, a recently-arrived passenger. Mr. Brown had gone on to Newark but his hat was placed on the plane and he was wired that it was coming.


Stinson 105
UPPER FORMERS
LOWER FORMERS
SIDE VIEW
TOP VIEW
FRONT VIEW
FIREWALL
TAILWHEEL DETAILS
COIL DETAIL
BATTERY DETAIL
MOTOR MOUNT DETAILS
LANDING GEAR FAIRING
LANDING GEAR STRUTS
NOT TO SCALE
WIRING DIAGRAM
PROP LAYOUT
WING STRUT
ALUM TAB FOR LATERAL CONTROL
CENTERSECTION RIBS
WING RIBS SHOWING SLOTS FOR SPARS
DOOR
LINDBERG HORNET
POPULAR AVIATION
JULY, 1939

Anti-Aircraft Failed in Spain

(*Continued from page* 11)

30 and 50 pounds. When I first got to Spain there were, I believe, 22 batteries with the Russian guns, three with Skodas and two with the Vickers. Later on the government obtained 16 new batteries of Swedish Bofors guns of 4.5 cm. These were very fine guns with automatic fire and capable of shooting up to 60 shells a minute.

The range of these heavy guns was about 5,000 meters—16,400 feet. They did much good work on the front because there the bombers came over at about 3,500 meters (10,500 feet) and were well within range. These heavy batteries usually kept about six kilometers (about four miles) behind the front lines to insure a getaway in case the Franco troops broke through. It took us about 25 minutes to abandon a position and have time to pack and take all of our ammunition and equipment with us.

There were only two occasions when we left our position in a hurry and had to leave something behind. The first was at Alicaniz on the east front. It was on March 16, 1938. We left five cases of ammunition, but another gun crew barely managed to get out with its gun. The last truck to leave the position was under fire of Franco tanks coming up the road. Our co-battery had to leave two guns and all their other equipment. Two regiments were trapped and surrounded in that break.

The other time we had to pull out in a hurry was at Villa de Fames on the Lavante front, June 11, 1938. Franco motorized cavalry broke the lines and came through so fast that only two of our trucks got out on the main road before the rest of us came under machine gun fire. We got away, though, by taking to the side roads and traveling all night on narrow mountain trails. It was daybreak before we caught up to our first two trucks.

In addition to the heavy guns each battery usually had a couple of lighter weapons. We had with us some Swiss Oerlikon cannon. They are automatic quick-firing guns of 22.2 mm. with a range of 2,000 meters. Some of the other batteries had machine guns and there were a number of different kinds of these guns in use. Most widely used was the four-barreled Russian gun and another double-barreled kind, the name of which I never got. These were .50 caliber guns.

Besides the guns, the battery consisted of a range finder, round-table range computer, ballistics computer and a sound detector. The searchlights in the Loyalist armies were independent units. There was also a field kitchen, telephone center, first aid station and two observation posts. In all we had 132 men and officers to man this equipment and 12 trucks to haul us around. All three batteries in a group would be connected by telephone when in position at the front.

Much of our trouble came from ammunition. The men were well trained and the guns were of the best. And we were able to put our shells very close to the planes at which we fired. But it seemed that it almost took a direct hit to bring down a ship. The construction of the projectiles was such that the destructive force of the explosion in the air went in only one direction—forward in the line of flight of the shell. Unless the burst happened to come just in advance of a plane it did little or no damage. Later we got some new ammunition made in Spain that burst like a bomb—in all directions with equal force. These newer shells were better but by the time we began receiving them our guns were so worn that we were unable to place our shots as well as we had at first. The net result was about the same as before.

". . . I'm afraid I can't renew your pilot's license Captain Coffield . . ."

Considering the amount of money, the training and the number of men assigned to the anti-aircraft units the results they produced were almost nil. The real benefits of the training came when the light guns, particularly the Oerlikon cannon, were used in the trenches as anti-tank weapons or against low-flying bombers or swooping fighters. When used properly these light guns made a fair showing, but our heavy weapons were almost useless.

We had loose-leaf memorandum books that gave us considerable information about the various types of German and Italian planes that were used by Franco. Here is a list taken from my book with the names of the planes:

Heavy Bombers

Caproni tri-motored
Junkers Ju-52 tri-motored
Junkers Ju-86 twin-motored
Savoia S-81 tri-motored
Savoia S-79B tri-motored
Breda twin-motored
Cant Z tri-motored hydroplane
Heinkel 111 twin-motored
Heinkel 111 twin-motored hydroplane

Light Bombers

Heinkel "51"—single-engined
Heinkel "70"—single-engined
Breda? single-engined
Focke-Wulf single-engined

Fighting Planes

Henschel HS-122
Romeo RO-41
Fiat CR-32
Messerschmitt M-109
Heinkel 112

We learned a lot about the tactics of the bombers. Most of the landplanes were used at the fronts and on the inland towns and cities. Valencia and Barcelona were nearly always bombed by landplanes that came in off the sea from Majorca Island. In the raids on Valencia and Barcelona they were unescorted by fighters because the only defense of the city was the anti-aircraft guns. Definitely they had little respect for us.

The hydroplanes had peculiar tactics of their own. Usually they were used for night raids on ports and coastal objectives. They would come in with motors off, almost silent in a glide. They would be fairly low and would drop their bombs before the alarms would sound. Then, when the searchlights began hunting them, they would glide out to sea five or ten miles and alight on the water. There they'd wait until the searchlights went out, then they would take-off and return to drop some more bombs.

When I first joined the battery no thought was given to spreading of guns or camouflaging them. They were placed in line like field artillery. But at Mt. Alban one of our co-batteries was attacked directly and suffered heavy losses. We then adopted the cover-fire positions—placing the guns in a triangle or square so that each gun could be covered from air attack by all the other guns in the battery. We dug ourselves some bomb shelters about that same time.

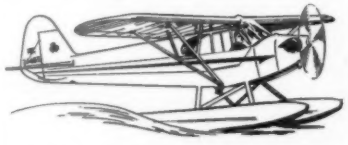
When bombing the trenches at Mt Alban the enemy planes would come over in three groups, nine planes to a group, each group in three units of three-plane vees. They discovered that our gun crews would dive into the bomb shelters when their bombs came close so then they evolved a method of keeping an entire battery silent with three planes while the others in a big formation would cruise around dropping their

(*Continued on page* 72)

UP IN VALUE!

DOWN IN PRICE!

MORE and more airplane for less and less money! That's the Piper policy for progress. Compare the *Piper Cub* of today at $1098 with the *Taylor Cub* of three summers ago at $1470. Better lines, more comfort, advanced safety, finer finish, and superior performance at a big saving in price! A two-place plane that will inflate your pride without deflating your purse! Up in value! Down in price! What a buy!



The Greatest of All Sports!

Here's a "2-in-1" Cub—a speed-boat and airplane combined. This summer enjoy the greatest of all sports—"aqua-air-planing." Seaplanes—complete with interchangeable Edo Floats and regular wheel-landing gear—from $1793.

ONLY $366 DOWN

If you wish to buy a Piper Cub "40" Trainer on the pay-as-you-fly plan, it is yours for only $366 down and the balance in easy monthly payments . . . Other Piper Cub models include 50 h.p. Trainers from $1298, 50 h.p. Sports from $1348, 60 h.p. Coupe at $1935 and 65 h.p. Coupe at $1995. All prices F.A.F. Lock Haven, Pa., and subject to increase without notice.

FREE FLYING COURSE

The authorized Cub dealer from whom you buy your new Piper Cub will arrange for you to receive a course of dual flight instruction in your own new plane by a government licensed instructor. Ask your Cub dealer about this free flying course and for a free flight demonstration. There are Cub representatives at all leading airports.

CUB "40" TRAINER $1098

FREE CATALOG

Send today for Cub catalog, details of the free flying course, and name of your Cub dealer. Piper Aircraft Corporation, 79 Aviation St., Lock Haven, Pa., U. S. A. . . . Cub Aircraft Company, Ltd., Copenhagen, Denmark.

Visit Us at the New York and San Francisco Fairs and at the Cub Factory

COUNT THE CUBS THE WORLD'S FASTEST SELLING AIRPLANE

Flying His Way Through College

(*Continued from page 39*)

The next year—1930—a plane Phillips was piloting was stolen from Searcy, Arkansas. It was the property of A. P. Noble, middlewestern business man. Newspapers played it up as a crime for which the thief would not easily be caught, because he had such a rapid get-away means at his command. But the lead of 600 miles didn't amount to much when the thief was forced down in a swamp near New Orleans; he was captured and given his just dues. It looked for a time as if the thief got the best end of the bargain at that. Phillips had to get the plane jacked up out of the swamp, moved to a road paved with oyster shell and the like. Then he had to jolt it into the air again from that road.

The fact that Phillips has never had an accident doesn't mean that his flying is done by the fireside. Cotton dusting calls for flying 10 to 15 feet off the ground in the early morning or late evening—to insure getting poison dust onto the weevils when there is as much moisture as possible on the plants. Trees loom up weirdly through morning mists. That calls for real skyrobatics, using 15 feet altitude for tree-hopping. Future flying ground is studied during the middle of the day ordinarily, and the flyer remembers obstacles as best he can. When Phillips flew through his power line, the darned thing had moved across a road on him.

It was also on a cotton-dusting job that he bent a prop. He sat down in a narrow flat field which was surrounded by trees and soon saw another pilot coming in behind him. Knowing the other pilot couldn't see his plane on the ground, Phillips taxied to the far end to make plenty of room. One wheel sank into a spot where water had run from a pump. The plane's tail lifted a little, the prop bit the soft ground and bent a little, the plane's tail settled back, and that was all. Not a great deal of accident in 4600 air hours. Not a great deal of accident in cotton-dusting work. At any rate, Phillips has a sheaf of telegrams from cotton-dusting contractors. They all read something like this: TWO SHIPS CRACKED UP TODAY. DO YOU KNOW WHERE I CAN GET REPLACEMENTS?

That's all background for the flying student-professor. More background is the service rendered the states of Oklahoma and Arkansas by his participation in 10 state air tours on one side of the line or the other. Those cavalcades of the air are run on schedule when everything goes right, including the weatherman. In spite of his record of safety, Phillips still knocks on wood when those air tours are mentioned.

Somehow, all his flying experience have centered around his home town, Ft. Smith, Arkansas. Ft. Smith is on the Arkansas River from which a big wind is always blowing, it seems, and there's a lot of air in circulation from the backwash of propellers. Which is by way of saying that some excellent air stories are alive there which sound exceedingly well.

Yet, just such stories go to prove one fact. Phillips and his brother-in-law, Floyd Munsey, are responsible for the civic aviation interest which procured the present airport for Ft. Smith. They are also primarily responsible for the interest which the city is taking now in building a more modern airport. Like almost every other city in the 40,000 population class, its first airport has been made obsolete so far as big transports are concerned. But, unlike many other cities, Ft. Smith is not blessed by a multitude of available sites—so that the job of building a modern airport isn't easy.

About the first thing anyone asks Buell Phillips at the University of Arkansas is, "Do you go in for football?" The Arkansas Razorbacks are always nationally interesting in the football line and Phillips—all six feet of him and all 200 pounds of him—looks like interesting football material. That is, all but his small hands.

However, his answer is, "I don't have any business playing with those kids. They'd kill me."

(*Continued on page 87*)

An Overwhelming SUCCESS!..

THE NEW LEARADIO APR-1 PORTABLE

Gets the weather reports . . . *DIRECT!*
Use it in your plane—in your home, office, hotel room, boat, or on the road. Works anywhere—entirely self-contained.

CHECK THESE FEATURES

- √ **Two bands: beacon and control tower—200-400 kc. standard broadcast—550-1500 kc.**
- √ **Weighs 8½ lbs. complete with long-life (over 125 hours) batteries.**
- √ **Compact (7⅝"x12"x4½")—sturdy and dependable.**
- √ **5 tubes—Long range reception.**
- √ **High fidelity speaker and built-in loop antenna.**
- √ **Includes connections for headphones and antenna.**
- √ **Aircraft engine shielding seldom required.**
- √ **Use in your airplane under your baggage weight allowance, eliminating special installation.**

Dealer Inquiries Invited

Special Learadio headphones for aircraft use $6.00 per pair. If bought with set $5.50.

$39.50 COMPLETE

THE PILOTS' PREFERENCE

LEAR DEVELOPMENTS INC.

Learadio

ROOSEVELT FIELD, MINEOLA LONG ISLAND, N. Y.

Export Department: 17 State Street, New York
Cable Address: LEARVELOP

HERE'S THE NEW, SPIRITED

AERONCA

Chief 65

PERFORMANCE AND BEAUTY CHAMPION

Get all the facts before you buy and you'll fly a "Chief"

Again Aeronca offers you brilliant performance in the new "Chief 65" — it's another champion — extra power and speed with the same built-in leadership qualities that placed the "Chief 50" out in front. Month after month of large sales increases shows the trend — the swing to Aeronca — more and more people have recognized the outstanding craftsmanship, beauty, comfort and superior flight characteristics of the "Chief." All we ask is that you compare. See your Aeronca dealer for a free flight demonstration — the sooner you find out about the big value "Chief" the quicker you, too, will want to own one. Write today for his name and free descriptive literature.

FOR THOSE WHO WANT THE BEST AT LOWEST COST

When true values are considered, Aeronca gives you the most for your money — and, too, you'll be proud to say "I fly a Chief".

The new "Chief 65" only $1845 F.A.F. CINCINNATI, OHIO

Two doors and carpet standard equipment on all Chief models. Aeronca airplanes deliver for as low as $464 down.

EASY PAYMENT PLANS

DUAL STICK OR WHEEL CONTROL NOW OPTIONAL ON ALL AERONCA AIRPLANES

Proven Champion of AERONCA Chief 65 the Low-Price Field

AERONAUTICAL CORP. OF AMERICA · E-6 LUNKEN AIRPORT CINCINNATI, O.

The Thunderbird

(*Continued from page* 50)

wildly gyrating, missed the teeth of another rock and then fairly aimed for the narrowing channel dipped a bow and shipped water. That was the beginning of the end. Mois, knew he could do nothing so, poising himself on the thwarts, he dived into the water. Fighting bravely he managed to get ashore.

Mois Mirasty struggled from the waters of the river, brushed the spray from his eyes and looked out just in time to see Tommy Morin and his son Johnny disappear beneath those fuming waves in the rapids. They were dragged under by the current and drowned before he could do a thing to aid them. Stumblingly he made his heavy way to the camps of the Crees.

In the native camp, Mois hung his head in shame. Far better that he too had gone down with the boat than he should desert his friends in their hour of need. Still, it was every man for himself at that moment. Once the engine failed he could do nothing. He had been lucky to save himself, but that brought him small comfort now. He could not face one of his friends despite their protestations that he could have done nothing but save himself.

Again, he heard a roar in the skies. Looking up he saw another "thunderbird" hurtling toward Flin Flon. The spreading wings cast dim shadows from the pale sun and Mois sank still deeper in melancholia. The blast of the motor seemed to shout a reproach to him and his mind ran back to the time when another Indian, Buster Whiteway, had been a passenger on a "thunderbird."

At that time, the snowdevils had whirled down from the north and blinded the pilot. Hungry fingers of death had torn the "thunderbird" from the sky and smashed it onto Moose Lake. That Indian "Whiteway" had not run. He had fought a terrific fight and saved three men. He, Mirasty, had jumped from a canoe and two of his best friends had drowned. There was a great deal of difference in the two incidents, but Mois couldn't see it.

For more than a month, Mois Mirasty mooned about in despond. He wandered from place to place but could not rid himself of the terrible feeling of guilt. Suddenly it came upon him he should kill himself and thus regain his face. A hundred years of civilization had swept by but the noble traditions of a great race still lingered. Mois determined to kill himself.

At the Pelican Narrows Post, Mirasty made his first attempt at death. With a hunting knife he slashed his throat, but the wounds were not deep enough to kill him. Friends seized him and soon the white doctor sewed the gashes up, spoke soothing words and let him go. An hour later he attempted to strike himself on the head with an axe. Truly he was becoming more and more demented.

And now, his friends rallied about him still stronger. By night they would tell him of many things whereby he was a hero and not a coward. They showed him where he was in no wise to blame for the death of the Morin father and son. The white people at Pelican Narrows also talked to him and soon he became normal and commenced to do small jobs around the post. One of these jobs was, packing bales of fur so they would be ready for the "thunderbird" of the Arrow Airways when it arrived.

Meantime, other friends of Mirasty decided to send him to the hospital at Flin Flon and give him a chance to rest. They felt it would do him good and he would forget the tragedy of the Whitesand Rapids. Accordingly they made arrangements with Arrow Airways to take Mois in when they called for the furs.

Capt. "Jeff" Home-Hay, veteran war flyer, hero of the famous Trans-Canada flight in 1919 and hardened pilot of the grim north country, shoved the gun wide open and listened with satisfaction to the roar of the big *Wasp* motor as it lifted the Fairchild off Schist Lake at Flin Flon.

Four hundred and twenty horsepower whisked him through the air toward Pelican Narrows where he would pick up a cargo of valuable furs and something had been said about an Indian passenger who was to be brought to the hospital.

Jeff wondered what the Indian's trouble could be. He had brought many of them out for medical attention and found them all quiet well mannered chaps. Nothing like the boisterous prospectors and hard rock men who wrested riches from that frozen land. This might be a stretcher case and if so, Jeff would have to stow his cargo carefully to make room for the stretcher. In any event he would wait until he arrived at Pelican Narrows.

The little trading post of Pelican Narrows was in a state of excitement as the bales of valuable furs were placed aboard Home-Hay's Fairchild. Checking over his cargo, the veteran pilot saw it stowed, according to regulations and then turned to look for his passenger.

He saw the swarthy face of Mois Mirasty as he bid goodby to his friends and was pleasantly surprised to note the Indian was in good spirits. Happy smiles wreathed the bronzed cheeks and a moment later, Mirasty, made himself comfortable behind the fur bales in the cabin of the ship.

Home-Hay, anticipating a speedy trip back to Schist Lake shoved the throttle open as the nose of his plane swung away from the dock. With a welcoming roar, the 420 *Wasp* burst into song and as the wings took the lift, the Fairchild left the water and headed out for Flin Flon.

One thousand feet below, the rugged granite studded wilderness rushed by the fleeting Fairchild. Nimbus scudded down the sky bringing a threat of snow from the north as Home-Hay sighted Annabelle Creek region. Soon he would sight Wilderness Lake and then it would be a short hop home. It would be good to feel the pontoons touch the friendly waters of Schist Lake once more. Swinging the nose of his ship about, the pilot turned and approached the east end of Wilderness Lake.

In the cabin, Mois Mirasty listened to the steel throated song of the "thunderbird." He had heard that sound before and it had shouted shame at him. The quiet man up in the pilot's seat must know of this for the motor was shrieking it into his ears. Possibly it was this very man who had seen the disaster from the air and now bringing him out to ridicule him before the white people.

The men who rode these ships of the sky thought little of death for did they not laugh at the storm king and the "weetigo" who sought to tear them apart?

What must such men think of him? Suddenly the full horror of the situation smashed into the disordered brain of the big Cree. Mois Mirasty, direct descendant of a famous race went stark raving mad in a "thunderbird" of the white men piloted by the unsuspecting Home-Hay.

More than one thousand feet below, the glistening stretches of Wilderness Lake came under the port wing. The big *Wasp* was rippling over nicely when Home-Hay felt the Fairchild lurch wildly. Correcting the position of the ship, the pilot was alarmed to note his craft was rocking and swinging about. Turning his head he looked into the cabin and saw his erstwhile peaceful passenger hurling himself against the sides of the plane.

With his innate savage instincts aroused, Mois Mirasty, bent on self destruction was also threatening the safety of the big Fairchild. Owing to the short flight and comparatively heavy payload, Home-Hay was without an air engineer. He could not leave the controls of his ship and attempt to subdue the maddened Indian.

He could do nothing more than hang on and trust to luck. Whichever way he regarded the desperate situation he was helpless. If he attempted a fast landing, the Indian might rush to the pilot's compartment and start serious trouble which would end with the destruction of both the plane and its passengers.

Were he to stay in the air and keep plenty of altitude there was a chance the maniac would smash his way through the side and plunge to death a thousand feet below. Jeff Home-Hay was in what is particularly known as a very "hot spot."

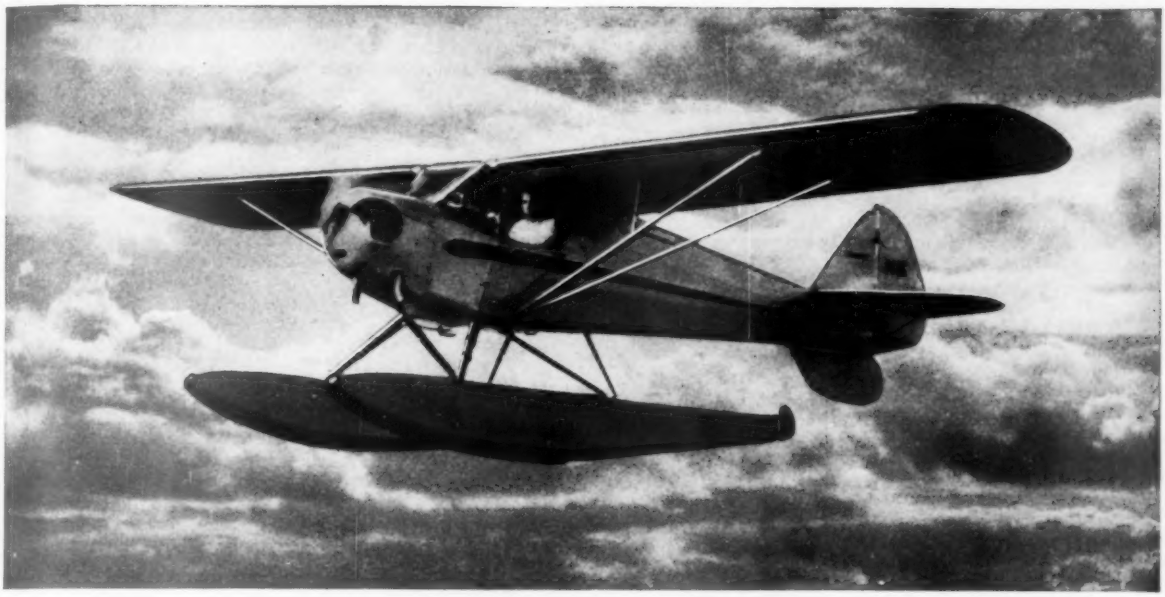
Again and again, Mirasty crashed against the cabin walls. Behind the bales of fur he flung himself here and there in a desperate endeavor to do himself harm. The ship rocked and lurched with the unusual disturbance but Home-Hay's iron nerve did not desert him. Holding the heavy plane on as even a keel as possible he prayed for the best.

Peering over his shoulder he saw the reddened eyes of the maniac glaring at him. If ever a pilot was in need of immediate help that man was Jeff Home-Hay. Roaring along at 120 m.p.h. with a wild country a thousand feet below him and a maddened savage of that wild country in the cabin behind. Grim-lipped and determined, Jeff did what he

(*Continued on page* 89)

ANOTHER WORLD'S RECORD

—AGAIN IT'S *Taylorcraft*



THE RECORD — Non-stop, non-refueling record for seaplanes having less than 397 cubic inch piston displacement — 2000 kilometers (1242 miles). This International Record was made April 22 under the supervision of the NAA and Official Timers, on a closed course.

THE SHIP — A regular stock model Taylorcraft — powered by a stock Lycoming 55 HP dual ignition engine with only 145 cubic inch piston displacement. Owned by Lubrizol Corporation — equipped with Edo floats in which extra fuel was carried.

THE PILOT — Mr. Dewitt Eldred of Willoughby, Ohio — the same man and the same ship which established another seaplane record on January 7 by making a non-stop, non-refueling flight from New York to Daytona Beach, Florida. Mr. Eldred is 6 ft. 2 in. tall and weighs 215 lbs. Taking off the water with the weight of 74 gallons of gasoline (more than 6 times normal capacity), pontoons and an extra heavy pilot, is "real performance" says Eldred. And, using less than one quart of oil for this record distance with a total cost of less than 1½¢ a mile for fuel and oil, is "real economy".

NEW LOWER PRICES— PLUS NEW FEATURES

*Sound Proofing
*Chrome Plated Control Shafts
*Floor Carpet
*Deeper Baggage Compartment
*Adjustable Window Ventilation
*ALL STANDARD EQUIPMENT

†Bedford Cord Upholstery
†Polychromatic Blue Finish
†Optional at no extra cost

Parking Brake, Heavy Duty Service Brakes and Tail Wheel with Solid Tire only $75 extra.

THRILL to the glorious sport the rugged, dependable Taylorcraft will bring you. Enjoy happier week-ends to distant pleasure spots — hunting, fishing, swimming. Miles shrink and hours change to minutes as you ride in solid comfort above interesting scenery to your destination. You get places twice as fast as in a low-priced automobile — and at no more cost for gas and oil.

Seaplane or landplane, you'll find real fun in flying a Taylorcraft. So write, today, and let us arrange a demonstration. Then handle the controls yourself — experience the delightful pleasure that awaits you in a Taylorcraft of your own.

TAYLORCRAFT AVIATION CORPORATION
DEPT. 74 **ALLIANCE, OHIO**

Learn to Fly in the Plane You'll Want to Buy

Taylorcraft

It's Not All Hokum!

(*Continued from page* 23)

be these days. Now about the actors who work on flying pictures—the film aces, such as Clark Gable, Fred MacMurray and Cary Grant.

"Those guys can't fly airplanes and, if they could, they wouldn't be good enough to do what we have to do," Mantz says. "Why should they be? When an actor is called upon to do a singing part and he can't sing, they dub in a voice—when he plays the piano, runs a typewriter, stages a fight which might result in injury and does other difficult things, doubles are supplied. Even if an actor could fly—like Errol Flynn, or Brian Ahearne or Wally Beery—he'd be grounded, because he might get hurt half way through the picture and a million dollars worth of negative would have to be scrapped.

"So we have doubles in the long shots—these lads I've just mentioned. The actors don't risk their necks—but the pilots do. For close-ups, you have to have background shots. When Gable dived in 'Test Pilot' that dive was made by a real pilot. First, because the clouds had to be going by behind him to show that he was diving. Second, because there had to be a sound track of a diving motor.

"It's no secret the way close-ups are made. A plane is dismantled, taken on a sound stage and is set up. It is anchored on a pedestal in front of a huge sheet of ground glass. The actor gets into the cock-pit. A wind machine is started to give a propeller blast. Far, behind the ground glass is a projection machine which sends onto the ground glass the 'background'—the cloud effects or what have you which the pilots have been spending days or weeks filming. In front of the plane, synchronized with the projector, is the camera.

"To further illustrate—if you saw 'Men With Wings' you saw Ray Milland dive several times on a military field, look back and smile as the ship he was 'flying' seemed to do a climbing slow roll. Ray was in the cockpit of a fixed ship—the background did the climbing slow rolls. And it was making such a climbing slow roll that Frank Clarke almost wrote himself off!"

Close-ups only are faked. When you cut away from the long shots to the actors' faces you know that the work is being done in "transparency." But when you have long shots, 99 times out of a hundred one of the Hollywood flyers is whipping the ship around. So why cry hokum? Half of all the pictures made have up to 25 per cent of "transparencies" in them, with players in Hollywood walking across Brooklyn bridge, riding in railroad cars that never move, driving racers that are standing still, walking along Wall Street or in front of the Taj Mahal.

"Aviators are very sensitive about their airplane pictures," Mantz says. "Too sensitive. They say, 'Give us a picture of a nice, gentle pilot who never gets into any trouble. Be constructive about aviation!' Sure—and everybody would stay away. You have a war picture and people pay to see drama and tragedy; you have an automobile racing picture and either the hero or the villain goes on his ear several times; you have a cops and robbers picture and it isn't fun until they start bumping off each other; murders are a part of detective stories, train wrecks are a part of train stories and boats go down in hurricanes. So it looks as if there'll be crashes that will linger a little longer and there's nothing we can do about them. Furthermore, anyone who raises a beef about the crash of the pioneer aviator in 'Men With Wings, might just as well shout about filming a sunset. Such crashes used to happen every day, just like sunsets—and you can't deny them. In the early days of flying 10 per cent of the flying population died each year.

". . . That new engineer doesn't seem to care whether the Army Air Corps gets its planes on schedule or not . . ."

"Of course, sometimes non-flying writers of aviation thrillers go too far. They don't know much about flying and then the director has to pull their chestnuts out of the fire. You'd be surprised how many hair-raising scenes have been ducked by directors who know their flying and by technical directors. The leading air directors, including William A. Wellman, of 'Men With Wings,' Clarence Brown, of 'Night Flight,' Howard Hawkes, of 'Only Angels Have Wings,' and Victor Fleming, of 'Test Pilot,' all have flown, all love flying and put their hearts into their work.

"There are screams of technical errors always. One per cent of the people who saw 'Test Pilot,' who knew flying—perhaps even fewer than that—laughed at the huge sand tonnage which went up in the bomber. Sure—and Fleming knew they would. But he had to get over the fact that the ship was heavily loaded to millions who know nothing about aviation—and he couldn't have made his photographic point with the usual load. As far as being able to bail out at 400 m.p.h.—ask Jimmy Doolittle if it can't be done. He's done it. And fault is found that the plane went away faster than Clark Gable! It would. It was doing 400 and Clark slowed down to 130—maximum rate of fall—as soon as he left the cockpit. You slow down so fast you have to watch out that the leading edge of the horizontal stabilizer doesn't clip you."

The night I talked with Mantz about hokum, he was just a little bit stirred up by it all. He'd been spinning a Ford tri-motor all day. He'd been hauling the wheel back and twisting downward for 6,000 feet, making as many as 20 turns in each plunge. He'd had to do it again and again because the Ford kept wanting to pull out and each time he'd have to put more weight in the tail to make it spin longer.

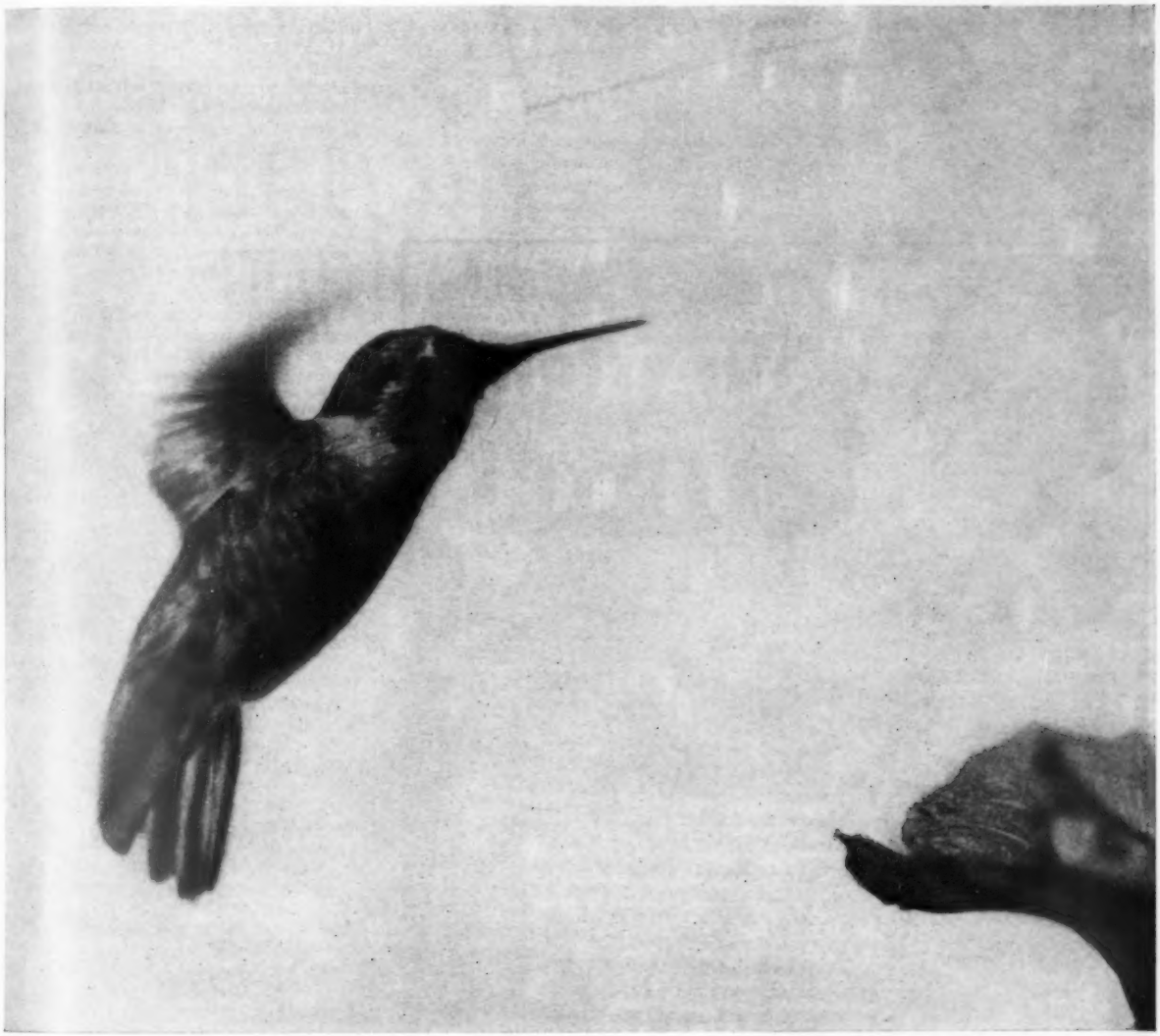
The people who yell "hokum" don't know that almost a year ago Clarke ruptured a blood vessel in his head doing one of those screaming power dives and that he's just getting over it. They don't stop to think that the boys build up their own ships so that they fly "X's" so much that when they get into a "C" they feel so safe they have to fight to keep from dozing and that when a director asks for a dive that's "better than anything in real life" they go out and do it. Too many fine pilots went "a little too far" trying to please a dramatically-inclined director. Many directors know little or nothing about aviation—and care less. Consequently, some of the things they demand gives a pilot the jitters.

Mantz tells about flying a ship with a technicolor camera strapped on the fuselage between himself and the vertical stabilizer.

"It was so wide I couldn't see the rudder when I looked back. In fact it was so wide that it took the propeller blast off the rudder. In taking off, I first used the steerable tailspin and then, when the tail was up, the brakes to keep the ship straight. I had to land at 100 with power to give me rudder control, cut the throttle the minute the wheels touched, and then keep the wheels straight by pedaling first one brake and then the other."

(*Continued on page* 85)

HELICOPTER?



CLOSER and closer man comes to practical vertical flight. But it's an old story to this little fellow... a Black-chinned Humming-bird. He can not only rise vertically and hover in mid-air, but he can actually fly backwards. To attain this unusual performance nature has given him an unusual "power plant" that turns up 12,000 wing beats a minute.

Flight, whether bird or man-made, vertical or horizontal, is inseparably linked to power. Through steady improvements of fuels and engines, aviation has conquered the "impossibles" of centuries. It is logical to assume that these advances will continue... and they must continue to come from improvements in fuels and engines.

That aviation engineers will always have fuels available that permit further progress, Ethyl engineers are daily aiding in practical research . . . to help provide tomorrow's fuel for tomorrow's plane.

ETHYL GASOLINE CORPORATION, ***manufacturer of anti-knock fluids containing tetraethyl lead***

"Shorty"

(*Continued from page 28*)

written about these high-altitude flights of Shorty's, he's never told the story publicly himself prior to now. Listen to his own version—it differs considerably from those of other persons who have told it for him:

"I got off quickly and began the climb. The ship and motor were operating perfectly and we soon were above 30,000 feet. I must have been smothered into unconsciousness because the next thing I knew I was looking over the left side of the ship. Some dark blurred mass seemed to be going past at regular intervals, but I wasn't particularly interested because it all seemed so dreamy. The mass went round and round. Finally I took a good look and saw that what I was seeing was the city of Dayton and that I was spinning—not the city. When I checked the spin I found I was down to 8,000 feet in good air. It had revived me."

On the next flight 20 days later Shorty tried to avoid oxygen failure by carrying two supplies. This was entirely in keeping with his famous "twin" theory that was well developed by that time. One of Shorty's oxygen bottles was connected to an automatic regulator. The other supply was connected directly to his mouthpiece with its own separate rubber hose for emergency use. The climb begun, all went well until Shorty's altimeter showed 36,000 feet. He was feeling some ill effects and noticed that the automatic regulator for the main oxygen supply had failed. He immediately shifted over to the emergency bottle and mouth piece in his face mask.

"I realized that with only this bottle of oxygen left that I would not get much further than 40,000 feet. Also if I used up all the oxygen in my climb it would be better to dive back down into the good air below 20,000 feet instead of spinning all the way down at a slower pace," Shorty wrote later.

"An hour passed and I still was climbing. I was using more and more oxygen until I got close to the 40,000 foot level. Then I became dull again and realized the oxygen in the emergency bottle was about gone. I wanted to reach the 40,000 foot mark.

"I tried to break the metal pipe off the first bottle of oxygen so I could slip the rubber emergency hose over onto this unused bottle and go on. The air temperature had gone down to 60° below zero, but during the last thousand feet of climb the temperature began to warm up—not much—but it was only 65 degrees below zero. This was proof that I had then entered the stratosphere (Shorty was the first man ever to reach this zone).

"But now I was woozy. In a desperate effort to get the hose over onto the first bottle I removed my goggles so that I could see. The moisture on my eyeballs froze and I was blinded. I reached up to cover my eyes and accidently knocked the oxygen hose out of my mouth. There I was, close to 40,000 feet, no oxygen, eyes frozen and body stiff with cold in that open cockpit.

"I repeated the now-familiar words, 'In case of darkness, oxygen failure, dive to twenty thousand feet and loaf from there down."

The words were the last he remembers. He reached for the ignition switches, but never made it, although he pushed the control stick forward for the dive to 20,000 feet into the relatively thick, life-saving air at that height.

The barograph charts on the ship showed that the dive ended at 2,000 feet. Shortly later thought that the collapse of the nearly emptied fuel tanks in the plane—squashed flat by the sudden return to near-sea level density—jolted him from unconsciousness and he automatically pulled out of the dive. He had dropped 36,000 feet—seven miles—in two minutes, 11 seconds.

Even then he couldn't see. His frozen eyeballs had rolled back in his head. Trying desperate measures he pulled down his frozen eyelids with one hand and warmed the eye. After a few seconds he was able to see for a few more seconds before the eye would roll back in his head again.

Somehow—he doesn't himself know just how—he got his plane headed back for McCook Field at Dayton. Seeing only a few seconds at a time he turned into the wind and headed for a landing.

(*Continued on page 86*)

Want to Get into AVIATION? Then Join us fellows at LINCOLN

LISTEN FELLOWS: Aviation is the thing to get into these days. It's got more zip, more opportunities and it pays bigger money than anything else I know of. Believe me, I'm glad I came to this Lincoln Government Approved School for my training. Lincoln's got everything.

There's a fleet of 15 snappy Training planes; a keen airport; flying country that's flat as a table and Instructors that really know their stuff. There's a huge Mechanics School with all kinds of airplanes and engines for us to work on and say - these students here are helping build the keenest new airplane you ever saw.

Believe me, these Lincoln Graduates sure get the jobs! About 30 men have stepped into good-pay jobs just since I came. The other day, a former Pilot Graduate visited the School. He's now Pilot on a big Airline; makes $600 a month. A recent Mechanics Graduate wrote that he made $165 his very first month out of School. The School's Employment Department helps its Graduates into these jobs.

Why don't YOU join us here at Lincoln and get ready for YOUR place in Aviation. The School will gladly send you complete information about courses. Just mail the coupon below. By the way - students here can do part-time work for their board and room while in training. It's a big help.

Vincent

Student at Lincoln

LINCOLN AIRPLANE & FLYING SCHOOL

117 Aircraft Bldg., Lincoln, Nebraska

I'd certainly like to get into Aviation. Please send me complete information about your courses of training.

NAME ..... AGE .....

ADDRESS .....

CITY ..... STATE .....

The only certificated school in America standardizing on MILITARY TYPE TRAINING PLANES

Above is an actual photo of Ryan students in formation flight practice in modern metal Ryan S-T military type trainers. The Ryan School maintains America's finest training fleet and is the only school offering up-to-the-minute military type equipment to every flight student, regardless of his course! Summer term opens July 5th but *High School* or *University* students who wish to take training during summer vacation should report at Ryan immediately after close of current semester. Mail coupon for complete details.

RYAN SCHOOL OF AERONAUTICS
FLYING ★ MECHANICS ★ ENGINEERING

T. CLAUDE RYAN, manufacturer, pilot, educator with 21 years experience in aviation. Founder of aircraft companies bearing his name, products of which include America's most modern metal, sport, training and cabin planes.

RYAN SCHOOL OF AERONAUTICS • Lindbergh Field, San Diego, Calif. PA-7

Please send information on courses checked.

FLYING COURSES
- ☐ Master Pilot
- ☐ Commercial
- ☐ Limited Commercial
- ☐ Private
- ☐ Solo

☐ Deluxe Combination—includes a new Ryan S-T-A plane with complete commercial course.

TECHNICAL COURSES
- ☐ Aeronautical Engineering
- ☐ Airplane Drafting and Design
- ☐ Master Mechanic
- ☐ Master Mechanic and Flying
- ☐ Aircraft Welding
- ☐ Advanced Navigation
- ☐ Master Radio

Name_____ Age_____

Address_____

City and State_____

Please Print or Type

Distinctive

Convenience, gracious service and quiet luxury distinguish this world-famous hotel. Here an atmosphere of true refinement is enjoyed by the most discriminating.

Under the same management as the internationally famous Gotham, New York City; Drake, Chicago; and Town House, Los Angeles.

A. S. KIRKEBY
Managing Director

The Blackstone
MICHIGAN AVENUE
CHICAGO

Are Flying Boats . . .

(*Continued from page 26*)

day when it made a forced landing in the interior of Cuba. No one was hurt and it didn't seem to do any damage."

The pilot laughed. "Yes, I remember that," he replied. "This is the same ship that made the ploughed-field landing, and I'm the same pilot!"

He didn't explain how the ship was moved to the nearest water. That, of course, must have been a feat. But, in an emergency, it is comforting to passengers to realize that an airboat can sit down anywhere a landplane can, and many more places besides.

The U. S. Army and other organizations have had experience with amphibians landing on an airport with the wheels retracted because the pilot forgot to lower them—a fairly common occurrance a few years ago. Seldom has serious damage been done in such landings. The hulls of amphibians and airboats are built to withstand high impact loads. A landplane alighting on anything except a smooth field would have its wheels retracted anyway, to avoid nosing over or ground looping. Though passengers and crew might escape injury in such landings, certainly the plane's belly, wings and propeller would be damaged. The airboats wings and propellers, built high to clear the water, would be more likely to avoid damage in an emergency ground landing.

Of course a landing in mountainous terrain would be disastrous to either type of plane. But then again, the airboat flying cross-country would be safer if it lost its way, because there are always alternative bodies of water in all directions scattered over the country. The landplane off an established airway is helpless until it finds another airway with its line of emergency fields and airports, and these usually are hundreds of miles apart. The same applies when a different route must be taken because of a sudden storm.

Because water landing areas often are unlimited, it is safer to land an airboat in poor visibility than a landplane, which must find a comparatively small target. Water take-offs also are safer in case of engine failure. The airboat has merely to settle back in the water, while the landplane is off its level runway and must crash.

If we concede the safety of airboats in cross-country flying, why, then, are they not used commercially in that work? At first glance the economics involved appears to favor the airboat. Probably the greatest saving would be in terminals and emergency fields. Water costs little if anything to maintain. In places where it does not already exist in convenient locations, dams might be built or basins flooded. These might serve also as recreation lakes, or as storage and power reservoirs. The Civil Aeronautics Authority has requested $37,000,000 for modernization of airways. A small part of this sum would provide a cross-continental airway for the big boats.

Passengers likely would prefer airboats, especially when great speed and a direct route are not essential. For one thing the necessarily high wings offer an unobstructed view of the ground. And then waterways, with their shipping and vegetation, are always more interesting than straight land. Certainly resorts would develop at some of the more picturesque stopping places.

Along the coasts, from Maine to Florida, from San Diego to Alaska, there exists almost continuous landing areas of harbors, esturaries, rivers and lakes. The Coast Guard and the Navy have used these daily for years in routine patrols and maneuvers. Yet the possibilities have barely been scratched by commercial operators.

The trans-ocean lines probably will not bother with the coast trade, any more than trans-ocean steamers find it worth while to compete with coastal steamers. Coastal steamers act as feeders for their big sisters. It seems logical that coastal airboats should play the same part in relation to trans-ocean airboats. The necessary equipment would actually be cheaper per passenger mile than that used by steamship companies. There would be less initial expenditure and less operating cost.

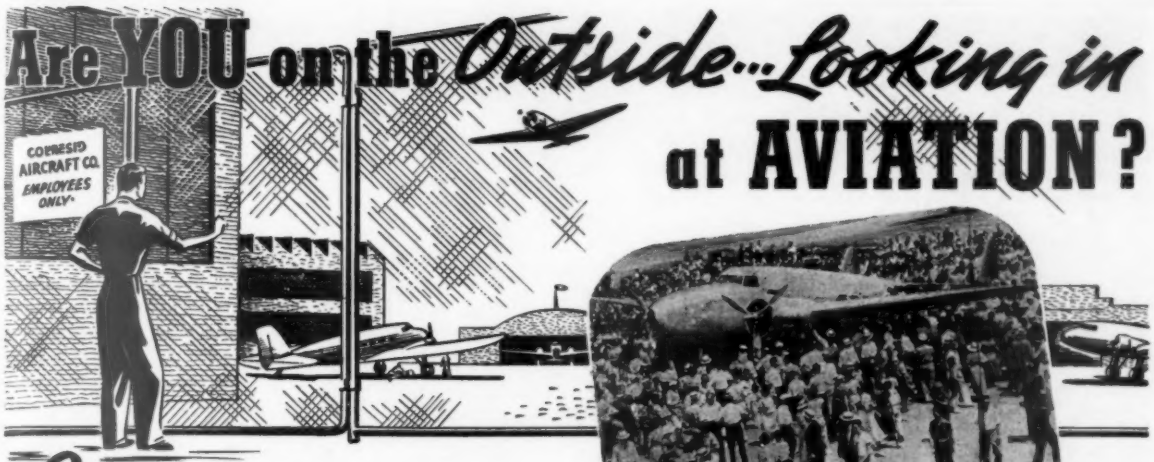
Now let's examine the drawbacks which, at present, are serious. One is the fact that some inland cities do not have convenient bodies of water. A way of overcoming this would be to use amphibians. They can be built as large as any landplane, and the cities on the route away from water would then have to accommodate them with landing fields of sufficient size. Amphibians, however, because of weight and drag, are less efficient than either landplanes or airboats. And yet, if the demand was great enough, engineers would find means for increasing their efficiency. Another means of serving cities off the waterways would be to develop artificial lakes. Very little depth would be needed—a landing channel six feet deep would do.

Another, though lesser problem, is that of pilots. The airboat pilot must be a good sailor as well. This was demonstrated several years ago when General Italo Balbo brought a squadron of Italian Savoia-Marchetti airboats on a trans-Atlantic tour. The pilots were all Army fliers, as was their commander. In preparation for the tour they were given what was then thought an extensive course in airboat work. It was not enough. They were still soldiers. Numerous disasters befell them, all during surface maneuvers and all due to poor seamanship. Commercial airboat pilots must be given special training.

The Civil Aeronautics Authority inherited a regulation prohibiting public carrier airboats from flying over land, though landplanes carrying passengers are permitted to fly over water. This is a foolish regulation and is almost certain to be cancelled soon. The CAA is now making a thorough investigation of three projected cross-continental routes for airboats and will probably be asking for an appropriation to develop one or

(*Continued on page 76*)

Are YOU on the *Outside*...*Looking in* at AVIATION?



Inside AVIATION

Aircraft Mechanics and Aeronautical Engineers *Share in this*

Its Stirring Deeds
—like completion of Howard Hughes' 'round-the-world flight
Its Engineering Triumphs
—like the Boeing 314 trans-Atlantic Clipper
Its Production Achievements
—like the building of the great Douglas DC-4

In the pages of this very magazine—or elsewhere—you have read about the big things going on in Aviation. But have you ever connected them with *your own future?* Why go on just reading for pleasure, about Aviation? Why not train to get into Aviation *yourself?*

Back of every plane that flies are Aeronautical Engineers and Aircraft Mechanics. According to your education, you can train to be one or the other. You can take training that *gets results*—as proved by the fact that 429 Aero I.T.I. graduates stepped into Aviation during the last 12 months. During a recent 60-day period 126 Aero I.T.I. men went with *one* aircraft plant alone.

The Aero I.T.I. Engineering and Aircraft Mechanics courses provide you with every means and every opportunity to *learn* what you MUST know...to *do* what you MUST be able to do. You may start your training at home...or take a full-time resident course at the Institute. For information on courses... including free descriptive booklet illustrated here...send the the coupon today.

AERO INDUSTRIES TECHNICAL INSTITUTE
5255 W. San Fernando Road, Los Angeles, Calif.

Please send information on your courses, including free booklet on Aviation and Aero I.T.I. training. I am interested in the branch of Aviation checked below:

☐ Aircraft Mechanics ☐ Aeronautical Engineering
☐ Undecided. Please send more information.

Years of High School: ☐ None; ☐ 1; ☐ 2; ☐ 3; ☐ 4.
Years of Jr. College or College: ☐ 1; ☐ 2; ☐ 3; ☐ 4.

NAME_____ AGE_____

ADDRESS_____

CITY_____ STATE_____ a-19-pa

AERO INDUSTRIES TECHNICAL INSTITUTE

5255 West San Fernando Road, Los Angeles, Calif.

Aircraft Mechanics • • Aeronautical Engineering

Offering U. S. Civil Aeronautics Authority Approved
12 Months Aircraft Mechanics Training

EXECUTIVE BOARD

C. A. VAN DUSEN
Vice-Pres., Consolidated Aircraft Corporation

JOHN K. NORTHROP
formerly
Pres., The Northrop Corp., and Vice-Pres. Douglas Aircraft Company, Inc.

ROBERT E. GROSS
President, Lockheed Aircraft Corporation

Anti-Aircraft

(*Continued from page 60*)

projectiles without interference.

Their planes assigned to bomb the battery would come over and drop a few bombs until the guns ceased firing. Then they'd cruise around and drop a few more at intervals to keep the crew in their shelters. This managed to keep the battery quiet until we worked out our cover-fire positions after which, although one battery would be silent, the guns of the covering batteries would be busy.

The stories about the bombing of Barcelona, Valencia and Cartagena were full of bunk. They said that Franco had some silent planes that were used in these bombings and that he had some wonderful new explosive more powerful than ever known before.

The silent planes were ordinary bombers that went very high and approached the cities with motors throttled back and with the plane in line with the sun. They'd come in, drop their load and be off before the sound detectors could give warning. Many times the bombs would be exploding before the batteries went into action. This of course, was always far too late.

The rebel bombers used high explosive, demolition and fragmentation bombs ranging in weight from 25 to 100 pounds on trenches. On wooded ground and ripe grain fields only small aluminum incendiary and demolition bombs were used. On cities, ports, towns and supply depots, railroad junctions and road crossings bombs from 100 to 1,000 pounds each were used.

The bombs that caused such devastation in Barcelona were 2,000 pound bombs. The explosive was similar to that used throughout the world by armies, but there was an awful lot of it in each bomb that was dropped.

Of all the bombers, the dive bombers bothered us most. I suppose it was the sound of the motor winding up in the diving approach. It was not, certainly, their accuracy. Most of the dive bombers would overshoot their target pretty badly. The bridge at Mora de Abro, for instance, was bombed more than 50 times by dive bombers and never was hit.

Again let me say the best line of anti-aircraft defense is the fast, high-flying fighting plane and the long distance heavy bomber. The fighters can engage the enemy before they reach their objectives and the long distance bombers can carry the battle to the enemy factories and airdromes whence their raids are launched. The farmers have an old saw that hits the nail on the head: "To destroy the weed one must first destroy the root and seed."

END

MOTORIZED VEHICLES

How to build 5 different scooters, motorcycle engined flea airplane, one-wheel bicycle, diesel conversion motorcycle, trailers, midget racers, airplane skis, light plane hanger, etc. No pictures but working drawings, blue prints etc. Large book. $1.00.

Kamm Metal Products Company. Dept. 2. 162 High Street, Oshkosh, Wisconsin.

He Designed a Tiger

(*Continued from page 54*)

and for three years was with the Consolidated Aircraft Corporation at Buffalo as project engineer for Air Corps pursuit and attack airplanes designated as Y1P-25, Y1A-11, P-30, and P-28—so that he had plenty of background experience on Army planes.

When Consolidated moved to California about three and a half years ago, abandoning its fine Buffalo plant, Woods went along—but not for long. Lawrence D. Bell, the dynamic driving force in Consolidated, was opposed to moving to California even though California was his childhood home. He preferred Buffalo. He threw up his job as vice-president and general manager of Consolidated, organized plenty of Buffalo capital and the Bell Aircraft Corporation—and was ready to begin work.

"Now," he announced to his new associates, "we want a real chief engineer . . . a go-getter who will design an airplane that can't be beat."

"Who will you get?" inquired his financial backers.

"Well, there's that kid Woods who used to be here with Consolidated . . ." began Bell.

His associates scoffed.

"Why, he's just a kid . . . just 30 years old. Hardly dry behind the ears." Bell nodded sagely.

"Just a kid," he agreed. "Hardly dry behind the ears . . . but that kid has the stuff. He'll put us over."

Immediately he dispatched a man to San Diego, California, to interview Woods. Would he come back to Buffalo to be chief engineer? He would—and did.

Immediately things began to happen at the big Buffalo plant. There was an air of subdued enthusiasm about the big plant as Woods began putting his ideas together, the ideas which he had been thinking of for years. Behind locked doors and with a force of 900 workmen pledged to absolute secrecy under penalty of prison terms under the espionage act, the *Airacuda* was put together. The *Airacuda,* named after the vicious, slashing barracuda, the most feared fish in the seas, was the result. This highly-maneuverable 300 m.p.h. fighter is designed to strike at invading bombers, battering and slashing at them as no tiny single-seater pursuit can do. Mounting two cannon that are accurate for two miles, she can keep up with the swiftest pursuit, battering away with her destructive cannon to wreak havoc on her aerial opponents where machine gun bullets might patter off harmlessly.

In spite of his Tiger of the Sky, Bob Woods really is at heart a home-loving, peaceful guy. He was married May 11, 1935, to Miss Betty Lou Schlegel, of London, Ohio, in The Little Church Around the Corner in New York City. They have one daughter Stephanie Gail, aged 2½ years.

Which, of course, rounds out a successful life story.

END

$1.50 TO GET YOU A PILOT'S LICENSE

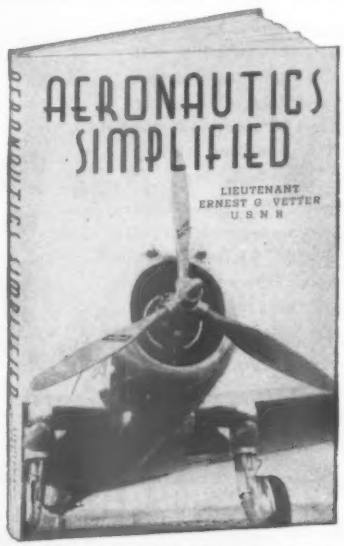
LIEUTENANT VETTER'S new book contains questions and answers you MUST know to get your pilot's license. It covers completely all government requirements and tells you exactly how an inspector wants you to fly a plane.

An experienced instructor himself, Lieutenant Vetter explains in amazingly simple form the theory of flight; functions of the engine; meteorology; navigation; the NEW Civil Air Regulations, with special attention to Air Traffic Rules.

Non-essentials have been omitted. Every fact in this book is vital to your success as a flier. We suggest that you can not afford to be without it at..... $1.50

COMPLETELY ILLUSTRATED

A MUST FOR STUDENTS!
A POSITIVE HELP FOR APPROVED PILOTS!



RIPCORD tells the amazing story of the invention of the parachute and the indispensable part it has played in the lives of aviation pioneers. Jam-packed with thrills, it has a real message for the student-pilot and aviator..... $1.00

Mail in this coupon with CHECK, MONEY ORDER or CASH, or C.O.D. Instructions and we will send you either book at its listed price. . . or the two books at the SPECIAL REDUCED price of..... $2.00

AERO-SIMPLIFIED ☐ RIPCORD ☐ BOTH ☐

Name .....

Address .....

MAIL TO Foster & Stewart, Publishers, 77 Swan St., Buffalo, N. Y.

BOEING SCHOOL PREPARES FOR TOP JOBS

Modern airline operations call for better-trained men. Boeing School, under the direction of United Air Lines, was established to train men for high career jobs in aviation.

And Boeing School men are making good! Let us show you the list of top men trained at Boeing—men who are making air history. When a man is needed for a new job—"He's Boeing" is as good a recommendation as he can get. 85% of all Boeing School graduates are employed.

At present there is a high demand for Boeing School trained pilots. This demand is likely to increase rather than diminish.

Government approved in ALL departments, the school is on the important Oakland, California, airport. Students work on actual flying problems, are trained in the radio room of United Air Lines, early become accustomed to airplane operation and construction.

If you are anxious to make your career a flying one—send the coupon below. You can enter classes in January, April, July, and October. Classes are in 12-week units. Classes are small, permitting individual instruction. Limited enrollment.

This is the only U. S. approved school owned by a major airline. The school has a world-wide reputation; students at a recent enrollment date registered from 30 states and 4 countries.

ENROLLMENT PERIODS: JANUARY, APRIL, JULY, OCTOBER

BOEING SCHOOL OF AERONAUTICS

11 CAREER COURSES

One specially designed to fit your chosen field of aviation.

Check the course or courses you are most interested in:

Courses requiring High School only

- ☐ Airline Pilot and Engineering
- ☐ Airline Operations and Engineering
- ☐ Airline Mechanic and Operations
- ☐ Commercial Pilot and Operations
- ☐ Airline Mechanic
- ☐ Aircraft Sheet Metal

(Private Flying Courses)

- ☐ Limited Commercial Pilot
- ☐ Private (or) Solo Pilot

Courses requiring 2 yrs. of college

- ☐ Air Transport Engineering

Courses for engineering graduates only

- ☐ Airline Technician ☐ Airline Meteorology

Courses requiring special training

- ☐ Special Airline Pilot ☐ Instrument Rating

NOTE: Link trainer and modern multi-motor instruction available to students in all courses.

Boeing School of Aeronautics
3079, Hangar No. 5, Airport, Oakland, California

GENTLEMEN: Please mail me, without charge, the 1939 BOEING SCHOOL BULLETIN containing complete information on the school and courses I have checked below.

Name.....

Street Address.....

City.....*State*.....

Previous Schooling.....

.....*Age*.....

UNITED AIR LINES

BOEING SCHOOL OF AERONAUTICS A DIVISION OF UNITED AIR LINES

Dirigible

(*Continued from page 34*)

joined to doom the *Akron.*

Improved weather-gathering methods and altimeters which remain unaffected by barometric pressure—because of an atmospheric pressure change, the *Akron's* instrument, merely a form of aneroid barometer graduated in linear units, registered 1,600 feet when the huge ship actually was only about 1,200 feet from the sea—these are but two of the needed refinements which will make airship operation (and heavier-than-air operation, also, for that matter) a disaster-proof proposition.

Because recommended structural reinforcements in the *Macon's* hull were postponed, the third of America's great dirigibles crashed into the Pacific four years ago—with loss of only two of her 83-man crew in a spectacularly efficient abandon-ship operation. This delay was effected only after careful consideration, Commander Rosendahl recalled, but the judgment eventually proved fallible. Had the frame been strengthened when the weakness was first discovered, the *Macon* might yet be flying today.

A survey of these three tragedies discloses, Commander Rosendahl contends, that human errors and scientific shortcomings (as in the case of unsatisfactory aerological data on weather to be encountered) were far more responsible than any inherent frailty of the dirigible as a class.

Let us suppose airship development is resumed on a large scale in the United States. What services could it perform better than any other type of transportation—services so invaluable as to give it as permanent a place in the American scheme as airplanes occupy today?

Commander Rosendahl has the answers ready. For Naval use the airship is unsurpassed as a long-range scout. Protected by its own planes easily released and secured to the hull, the dirigible can go long distances ahead of its fleet, climb above cloud formations, lower a sub-cloud observation basket barely discernible from the surface and enable its occupant or occupants to obtain vital information on the movements of the enemy in sufficient time for the defending warships to be properly deployed on the basis of that information. No heavier-than-air flying boat can boast the cruising range of the airship, none can hover almost motionless while observations are carefully made, none can take similar advantage of protecting cloud layers.

An airship with non-inflammable helium is not as vulnerable as the misled public has believed, Commander Rosendahl comments. Holes made by bullets through gas cell fabric and outer cover can be repaired in flight to a great extent, leaking cells can be isolated so as not to affect the ones still in commission and the judicious employment of an airship will keep it out of range of gunfire as much as possible, anyway.

Yes, the Zeppelin can and will bomb in the next war, but only in a minor role, Commander Rosendahl declares. Its main function is as a scout. Admiral Jellicoe, on the strength of his World War observations of dirigibles, claimed that the "Germans put them to the wrong use by bombing instead of scouting."

The airship, with its greater speed than a surface vessel and possessing the advantage of moving in the same element as airplanes, can be developed as an aircraft carrier of great efficiency, according to Commander Rosendahl. Also its tremendous range and carrying capacity makes it invaluable as a troop or cargo transport.

This is the characteristic least taken advantage of by the United States and the one which established German postwar dirigible reputation. The clipper ships now flying the Pacific suffer poorly in comparison with lighter-than-aircraft, Commander Rosendahl claims.

"Today's oceanic flying boats are in fact flying gasoline tanks rather than flying cargoes," he comments in reference to the airship's far greater carrying capacity—and he has the figures to substantiate this claim.

For the San Francisco-Hawaii run, the 26-ton clippers can carry a total payload of 1,500 to 2,000 pounds. The remainder is utilized by crew, equipment and fuel. On the other hand, the *Hindenburg,* on most of its 4,000-mile 1936 North Atlantic trips, demonstrated it could hold at least a 15-ton payload and as high as a 20-ton payload with three times the cruising range.

It would take 15 clippers at a cost of $9,000,000 (compared to about $4,000,000 for one airship), and would require a crew total of 105 compared to the airship's 40, to carry as many passengers, express and mail only one-third the distance.

Furthermore, elaborate stopover hotels in mid-Pacific islands would still be needed, passengers would still have to be awakened at dawn to resume their trip and they wouldn't be a fraction as comfortable as those in the spacious lounges of a modern dirigible. These are Commander Rosendahl's graphic arguments.

When he left Washington after a four-year struggle to keep alive American interest in airships, there was talk of a 650-foot fabric training ship with 3,000,000 cubic feet capacity. When he arrived in San Diego as executive officer of the *Milwaukee,* he learned that these dimensions had been slashed and an authorization had been made for a 325-foot dirigible of only 1,000,000 cubic feet volume.

This, somehow, seemed the answer to the foreboding he might have had at Lakehurst that fateful day as he watched with horror each letter of the name *Hindenburg* on the hull of the proud airship erased by the flames of a world-shocking disaster. He knew more firmly then that only hydrogen, not airships, should be discarded. But inwardly he realized that the fate of the work to which he had given the best part of his career hung by a slender thread.

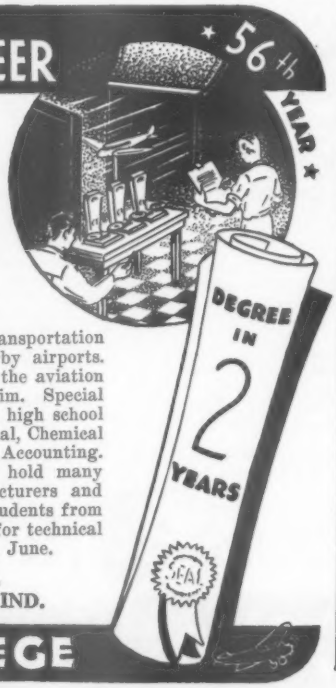
That he has retained his confidence in the utility, ultimate safety, and reliability of the airship is a tribute to the man's splendid morale. He has made clear to America the challenge now confronting this nation, the only wholesale source of helium. Whether this will constitute Commander Rosendahl's curtain performance in the U. S. dirigible scene will depend on how his country accepts the challenge.

But right now, it is about to lose its best talent in a field of endeavor that might yet change the course of history—with much the same impact as has the airplane.

END

Become an . . .
AERONAUTICAL ENGINEER

56th YEAR



· Bachelor of Science Degree ·

Course covers airplane design, propeller design, aerodynamics (including theory of airfoils, stability, performance, etc.), lighter-than-air craft, aircraft engines and all fundamentals. Equipped with modern wind-tunnel capable of 100 miles per hour air speed; accommodates a 36-inch test model. Non-essentials eliminated. The technical work ordinarily included in 4 years of college given in this course. Tri-State graduates in Mechanical Engineering can complete the Aeronautical course in 24 weeks. Study and analysis of entire field of air transportation included. Flying school facilities available at nearby airports. The trained aeronautical engineer is the key man in the aviation industry. Development and progress depend on him. Special Preparatory Department for those who lack required high school work. Courses also given in Civil, Electrical, Mechanical, Chemical and Radio Engineering; Business Administration and Accounting. Living costs and tuition low. Tri-State graduates hold many important positions with airlines, aircraft manufacturers and other companies in the well-paid aviation industry. Students from 48 states and many foreign countries. World-famous for technical two-year courses. Enter September, January, March, June.

Write for Catalog. *Burton Handy, Pres.*
779 COLLEGE AVE. ANGOLA, IND.

TRI-STATE COLLEGE

Why There Are More Opportunities *On the Ground*

ENGINE OVERHAUL

• No matter how skilful the pilot may be, he must depend on many trained mechanics on the ground to make his plane and keep it in flying condition.

That's why aviation needs more men on the ground than pilots. That's why ground men have so many more opportunities for employment and promotion.

The easiest way to get into aviation is *on the ground* . . . but the demand is for *trained men*. Before you take an examination for Aircraft and Engine Mechanic's Rating you have to be thoroughly qualified.

Stewart Technical School offers complete Courses in Aircraft Mechanics and Aircraft Engines, Aircraft Sheet Metal, and Aeronautical Drafting and Design.

AIRPLANE CONSTRUCTION

Drafting and Design

This Course appeals especially to those who are mathematically inclined and who prefer to qualify as aeronautical draftsmen and designers.

• Stewart Tech, established 30 years ago to train ambitious young men for technical occupations, has, for the last ten years, specialized in Aeronautics. It occupies its own 7-story building in Metropolitan New York—the air-transportation center of the Western world, where most transcontinental, South American and trans-Atlantic flights begin and end. Due to its location in New York, Stewart Tech students enjoy many cultural facilities.

New Classes Now Forming

Write promptly for free literature, or, if near the School, call and inspect our facilities and observe the actual training of students. When writing, please state age and education.

The School of Aeronautics

STEWART TECHNICAL SCHOOL

Dept. 127 Stewart Tech. Bldg. 253-5-7 W. 64th St. New York City

Approved by U. S. Government. Licensed by the State of New York

Are Flying Boats . . .

(*Continued from page 70*)

more of these before long.

But the greatest drawback is the cost of changing over to airboats, or of making the initial step in opening new lines for them. Airlines are already equipped with fleets of landplanes and the personnel trained to operate them. They have spent years and much money educating the public to their services. And, most important of all, no manufacturer is building commercial airboats on a production basis at the present time.

How would airboats compare in cost with landplanes? The only airboat manufactured in quantities is the Navy's PBY long-range patrol-bomber. It costs, completely equipped except for armament, from $110,000 to $115,000. The DC-3, slightly smaller than the PBY, faster and with better performance but less range and payload capacity, costs the airlines about $100,000. This is the closest comparison that can be made between airboats and landplanes. It is not altogether a fair comparison. The DC-3 is outfitted much more luxuriously than is the military plane, but does not need as complex equipment for navigation and radio. The PBY was first produced in 1932, the DC-3 in 1937, so that the latter has the benefit of five years more experience in design. Then too, the PBY would cost less if manufactured in quantities for commercial lines, because when built for the navy government inspections and red tape slows production.

It is probable that large airboats would cost less than comparable landplanes in commercial production. The hull of the airboat is more costly to build than the fuselage of the landplane, but the landing gear of the latter more than offsets the difference.

When a special landplane is developed the first model might cost as much as $2,000,000, as has the DC-4. Subsequent editions of the DC-4 will get down to a reasonable figure. Boeing contracted to build six of the "314s" at $500,000 each and is said to be losing money at that price. Now that the dies and tools are set up and production of this particular ship is organized, future "314s" should drop considerably in cost.

Last November Igor Sikorsky, lecturing in Berlin before the Lilienthal Society for Aeronautical Research, made aerodynamic comparisons of airboats and landplanes. At no place within known gross weight limits does the airboat possess the *aerodynamic* efficiency of the landplane, Mr. Sikorsky's figures show. In the very small sizes, around 2,000 lb., the airboat requires nearly twice the horsepower. Aerodynamic efficiency of each type of plane increases as the size is increased. *But*—from around 20,000 lb. to 200,000 lb. the airboat's efficiency increases at a much greater rate than that of the landplane. In the 22,000 lb. class the airboat requires 75.5 h.p. per ton (metric) of gross weight and the landplane 49.2 h.p. per ton. In the 110,000 lb. class the airboat rates 28.5 h.p. to the landplane's 22.8. The planes we have discussed fall between these figures, the PBY (commercial) weighing 28,000 lb. gross, the DC-4 65,000 lb. gross, and the "314" 84,000 lb. gross. But when still larger ships come, see how the aerodynamic comparison grows close. In the 551,000 lb. class the airboat requires 14.4 h.p. to the landplane's 12.7! Beyond this size the comparison is any man's guess, though it is reasonable to believe that the airboat, in sizes not yet conceived, will equal if not surpass the aerodynamic efficiency of the landplane. In the large sizes the landplane still has the edge in speed and climbing ability, the airboat in range and payload capacity.

The reason for these differences is due mainly to the shape of the airboat's hull, and to the landing gear of the landplane. In the small sizes the airboat must have a cabin higher than is necessary for crew and passengers, or else a superstructure, in order to keep the propellers above the spray level. Where the superstructure is used it takes several forms in different types of airboats. In the PBY it is a streamlined member housing the engineers' cabaña that raises the wing above the hull. Both the Martin and Sikorsky clippers have somewhat similar streamlined members to raise the wing. The Douglas *Dolphin* has its propellers raised above the wing. In either case a drag is caused. But the spray level remains nearly constant. Therefore if the airboat is large enough it may be designed aerodynamically perfect except for the bottom of the hull, and its propellers will be naturally placed high enough to clear the spray. No superstructure to raise them is needed. Examples of such large airboats are the Boeing "314", the Sikorsky XPBS-1, and the Consolidated XPB2Y-1. Landplanes, on the other hand, require a relatively more complicated and heavier landing gear as they increase in size.

So you have here a summary of some of the problems caused by increasing airport costs and landplane sizes. They inevitably bring up the question, "Will airboats be the answer?"

END

Other men have read and profited by our free books "Patent Protection" and "Selling an Invention." Fully explain many interesting points to inventors and illustrate important mechanical principles. With books we also send free "Evidence of Invention" form. Prompt service, reasonable fees, deferred payments. Write immediately to: Victor J. Evans & Co., Registered Patent Attorneys, 117-H, Victor Building, Washington, D. C.

PATENT YOUR IDEA

COLT 45 Cal. "FRONTIER" MODEL $1.45

Basswood construction kit with working plans, machined barrel, cylinder and all necessary hardware.

COLT 45 Cal. "FRONTIER" model kit, 4¾" barrel. $1.45
COLT 45 Cal. "FRONTIER" model kit, 5½" barrel. 1.55
COLT 45 Cal. "FRONTIER" model kit, 7" barrel. 1.70
COLT 45 Cal. Automatic Pistol kit. 1.00
Full scale Thompson Sub Machine Gun model kit. 3.00
SAVAGE Cal. 32 Auto. Pistol kit, machined barrel. .75
LUGER Auto. Pistol with 4" machined barrel. 1.75
LUGER Auto. Pistol with 6" machined barrel. 1.90
COLT 25 Cal. Automatic Pistol kit. .50

These beautiful kits are complete in every detail and made of the best basswood. All parts are cut to shape and require only a short time to finish. Postpaid in U. S. A.

GUN MODEL CO.
Dept. K67, 2908 N. Nordica Ave., Chicago, Ill.

BUILD ONE IN A COUPLE EVENINGS AT HOME

Megow's COMMANDER Gas-Powered MODEL

$4.95 plus 20c postage

FASTER and faster come new ideas from the experimental field and experimental laboratory work of Megow engineers . . . ideas that are producing the most interesting easy-to-build and easy-to-fly models in the world. If you really want to learn the principles of flying—without spending too much time on tedious details—build Megow models!

See your dealer, or send for new Megow catalog showing the latest championship gas and rubber-powered models and such advancements as Megow's hollow-carved and finished Leading Edge, revolutionary monocoque (skin construction) fuselages that are so easily and quickly built, PLANEFILM Magic Covering . . . everything that's newest in Model Airplanes, Ships and HO-Gauge Railroads.

Send 5c postage today for your copy of the new Spring and Summer Catalog

Megow's
Dept. PA, Howard and Oxford Sts., Philadelphia, Penna.
or 217 N. Desplaines St., Chicago,
or Great Western Merc. Co., 718 Mission Street, San Francisco

Monocoque constr. fuselage, hollow-carved Leading Edge, strongest wing constr. ever designed, Clark Y Airfoil, high Aspect Ratio. Extremely flat glide, max. climbing ability. Span 6 ft. Stab. span 29⅞ in. Wing area 570 sq. in. Uses any ⅛ in. motor. 3½ in. spec. rubber wheels.

New Class C Endurance Contest Model $1.50 *plus 15c postage*

Rubber powered. Latest type folding prop. increases glide. Wing streamlined into fuselage. Removable tail simplifies winding. Rubber Tensioner prevents shifting wt. of unwinding rubber. Span 41". Wt. 4.23 oz.

Brayton TEACHES CELESTIAL NAVIGATION TO *Commercial* FLYING STUDENTS

★ Brayton Air College gives training far in advance of today's needs. Brayton looks to the future. Brayton gives *extra* training in every course . . . training you may not now realize you need, but which you *will* need when you rise high tomorrow... Just one of these Brayton extras is the teaching of Celestial Navigation to Commercial flying students. That is but *one* feature of Brayton training, only *one* indication that Brayton looks ahead and leads in vision. It was because Brayton looked ahead yesterday, and last year and five years ago, that Brayton-trained men are leaders today... Skyliners fly through and above the overcast... have already reached the stratosphere. Tomorrow's flying will be more important than today's! How do you know how fast you will have to fly...or how far? Can you afford to risk your entire future...risk tomorrow's great opportunities . . . on less than Brayton training?

Brayton PRICES ARE LOWER

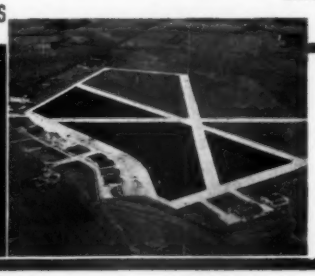
Brayton Air College is a small Institution of personalized, individual instruction in every division. Brayton is amply financed. The finest equipment is here for you to fly and work on, but there is no unnecessary overhead. For that reason Brayton tuition rates have always been low. Tuition fees are *still* low. Investigate Brayton training and Brayton prices at once. Write *now* for full information

ON $2,000,000.00
LAMBERT-ST. LOUIS AIRPORT

THE SCHOOL OF CHAMPIONS

Brayton AIR COLLEGE

Affiliated with Brayton Flying Service, Inc.



SEND FOR *Free* LITERATURE

BRAYTON AIR COLLEGE
LAMBERT ST. LOUIS AIRPORT
ROBERTSON, MISSOURI

Dear Mr. Brayton:
Please send me complete information about your training. I am particularly interested in
FLYING ( ) MECHANICS ( )

NAME _____

ADDRESS _____

"PLANE FUNDAMENTALS for FLYER'S LICENSE"
By Bert A. Kutakoff, Former Lt. S. Navy Pilot

147 Illustrations

A volume packed with essential aviation facts, 376 questions and answers necessary for license requirements on Airplanes, Engines, Navigation, Meteorology, Air Traffic Rules and Commerce Regulations, amended to the latest Civil Air Regulations.
A complete text for every Pilot-Student, Amateur, Private, Solo, Limited Commercial and Commercial Pilot seeking higher rating.
Endorsed by schools, flying clubs and thousands of individuals.
VALUE $3.00

$1.50

MAIL COUPON TODAY TO:
Power Publishing Co., Dept. P
40 Clinton St., Newark, N. J.
Sir: Please forward me ..... copies of "Plane Fundamentals for Flyer's License."
I will pay the postman on delivery ☐
I am enclosing—Money Order ☐ Check ☐
Name .....
Address .....
City ..... State .....

THE LOWDOWN ON A **1940** RADIO **TRANSMITTER**

RADIO NEWS, Dept. PA 101
608 S. Dearborn St., Chicago, Illinois
Enclosed find $1.50. Send me RADIO NEWS for one year (12 issues) and rush me a copy of the 1939 RADIO DATA BOOK without charge. (If renewal, check here ☐. If you are a serviceman, please check here ☐.)
Name .....
Address .....
City ..... State .....

★

TECHNICAL men in all fields will be interested in the 1940 RADIO NEWS "ALL-PURPOSE" Transmitter, its construction, installation, operation and efficiency. This unit is unique in the annals of modern radio transmitters.

★

JULY ISSUE
Radio News

'Safety' Planes

(*Continued from page* 18)

the ship was freakish in many ways and, secondly, because it was opposed and hated by the whole industry. The publicity surrounding the competition could not have been worse, practically condemning all other ships. The poor Stearman-Hammond was then either considered as the fair-haired solution to all our troubles—which it wasn't—or as the evil competition that was going to make all other airplanes obsolete, which it couldn't have done. It was built up to a terrible let-down.

It is sincerely hoped that we may again see this ship on the market in a modified form. It had visibility as no other ship before it. It used only ailerons to effect a turn and aside from an awkward yaw just as the ship left the ground, it behaved satisfactorily. Its tricycle landing gear was overdone to meet the requirements. It had an absurdly long shock absorber travel and the rear wheels were extremely far back, seriously reducing the take-off. This feature alone retarded the general acceptance of the tricycle for at least several years.

At the moment one of the saddest chapters in the development of the safe airplane is the Gwinn *Aircar*. It is sad from two viewpoints. First because a promising development is retarded by the publicity of an accident not in any way the result of the plane's novel features and secondly because it was so safe that it gave one of our finest pilots an over confidence in its abilities—and lost us Frank Hawks.

The *Aircar* also features two-control but, when we last flew it, it had not yet arrived at the best standards of this system largely because of its extremely short fuselage and large geared propellor which introduces difficult slipstream problems. It does make use of one important feature that was introduced on the W-1A and which will have to be incorporated in future planes—that of take-off flaps for tricycle gears. Without flaps or with the ordinary flaps that produce mostly drag for assistance on approaches, only the download on the elevators will raise the nose and increase the angle of attack of the wings enough for the plane to lift off. This loads down the main rear wheels and retards the take-off in comparison with a conventional gear where the wings may assume the load earlier in the run. In the *Aircar* the flaps produced a good increment of lift with slight drag and serve to get the load onto the wings and off the wheels during the middle part of the run, permitting the ship to take off in a nearly level attitude and as early as would a plane with a conventional gear.

The Waco "N", because it has only conventional flight characteristics, should not rate as a "safety" plane. However, its tricycle landing gear has given us a splendid direct comparison with conventional gear on the same style ship, much to the advantage of the tricycle. It even slightly outsold its competitor, the Waco Custom, in its first year's appearance. The additional drag—which is high when the nose wheel is directly behind a propeller—shows the need of retracting the three-wheel gear. We do not think that would increase the weight of most such airplanes.

The single-engined tractor airplane with its short nose is the worst design to mount on a tricycle gear because the wheel base is necessarily very short. The twin-engined tractor, or the single engine pusher (both of which naturally have long noses) lend themselves much better to the three-wheeled gear. This advantage coupled with the splendid visibility of the pusher and the removal of the propeller to a safe place behind the cabin, may soon swing the favor in layout to the pusher ship.

There is a new crop of safety planes springing up. The encouraging thing about their appearance is that this time, at last, it is spontaneous—not developed as the result of an artificial competition or the like. They are appearing in answer to an honest need and appeal from those who want to buy. Perhaps they will be assisted by the Civil Aeronautics Authority in the form of reduced flight time necessary to qualify for a certificate when taken on such ships. But this time the governmental action follows the trend and does not lead it artificially. This, of course, is the healthiest form of advancement and one that should continue.

One of the foremost ships in this crop and on which specifications have already been released is the Engineering and Research Company's *Ercoupe*. It has a tricycle gear, no flaps, and stall control brought about by a very carefully designed tail and wing combination. It is an amazing ship to fly, the tail never failing to control in any maneuver. No matter what is done to it, the ship levels out automatically and starts flying with a very slight loss of altitude. Such abuse would, of course, not keep it in the air long, but it would at least hit the ground level and under control—and a plane cannot fall fast when the wings are broadside to the motion. With power on the ship climbs even with the stick full back!

It features two-control on a new basis. The rudders are mechanically connected with the aileron system and both are moved by the wheel control, When the plane is steered the rudder and ailerons both move to produce a perfect turn. The effect is identical with two-control through the use of a huge fin, but it is probably lighter in weight as much smaller surfaces are needed. Rudder pedals may be installed to provide three control operation, if it is desired.

Whether we call them "simple planes" or "safety planes", they are with us now through normal channels of supply and demand. They will not revolutionize the market, but we think they are sure to profoundly improve it.

END

Criss WAS READY for this job!

When the Claude Drilling Company, one of the leading drilling contractors in the Petroleum Industry purchased their new **SPARTAN *Executive,*** the first need—was a pilot! Now, to intrust an investment costing several thousand dollars, you will agree they were NOT looking for just another pilot—or how cheap they could hire him. *Criss Morgan got the job!*

You CAN STEP INTO SUCH A POSITION

SPARTAN'S location at Tulsa, "Oil Capital of the World," is in the heart of the Petroleum Industry, LEADING USER OF AVIATION EVERY DAY IN THE YEAR. The center of the Southwest's IDEAL level flying country, without hazards of mountains, ocean fog or city haze and smoke. Here the days are clear, with bright sunshine the year round.

Criss Morgan was a lad like yourself when he left Mexico, Missouri, in 1935 to enroll at SPARTAN. Completing his Transport Course with the DAWN PATROL in slightly less than nine months, Criss spent the next year and a half on practical jobs in Aviation. Today at 25 he holds a responsible position commanding a salary that would do justice to a college man of 35. Criss Morgan like hundreds of other successful SPARTAN graduates, is an example of the opportunities waiting for TRAINED MEN in Aviation today. *Opportunities that assure* YOU *a successful career in Aviation!*

THE DAWN PATROL Was the FIRST Step!

SPARTAN SCHOOL OF AERONAUTICS

HOME OF THE DAWN PATROL

IN THE Tulsa CENTER of Nature's IDEAL Flying Country

SPARTAN SCHOOL OF AERONAUTICS, P. O. Box 2649, TULSA, OKLAHOMA

Send me a copy of the NEW 1939 SPARTAN Catalog and Supplement describing in detail Spartan Flying, Mechanical and Radio Courses of Aeronautics, Tuition and detailed living expenses.

NAME..... AGE.....

ADDRESS..... CITY..... STATE.....

Any Previous Flying Experience?.....

Check below branch of aeronautics you are most interested in.

- ☐ FLYING
- ☐ MECHANICAL
- ☐ RADIO INSTRUMENT
- ☐ EXECUTIVE-MANAGEMENT

MEN! GET THE FACTS ON THIS REAL TECHNICAL UNIVERSITY EDUCATION IN AERONAUTICS

In Less Time...For Less Money

MAIL COUPON TODAY!

Our outstanding faculty, aviation industry type of equipment and practical methods of instruction make it possible for AU to offer this thorough, state accredited aeronautical training . . . for a sensible time and money investment. Mail coupon NOW for complete facts about AU and careers in aviation open to AU trained men.

OVER 40 SUBJECTS IN

AU ACCREDITED

Aeronautical Engineering . . . Mathematics, Drafting, Airplane Design, Stress Analysis, etc.

Certified Mechanics . . . Prepares for Government Certificates; Airplane Engine and Radio. Sheet Metal, etc.

Administration . . . Transport, Traffic, Sales, Aerial Photography, Meteorology, etc.

AERONAUTICAL UNIVERSITY (P.A.)
(Founded by Curtiss-Wright)
Curtiss-Wright Bldg., 1338 S. Michigan Blvd., Chicago, Ill.
Send me FREE illustrated Bulletin.
NAME .....
STREET .....
CITY .....
STATE..... AGE.....

PHOTO ENLARGER $5.94

Money back guarantee
A REAL Photo Enlarger that does fine work. Focuses automatically. Also COPIES and has a Contact Printer and Retouching Table. Interesting circular free. Only $5.94 complete. Lens included.
IDEAL-H, 148 West 23rd St., New York, City

Power!

Catch It With Your Camera

If you've ever been inside a giant industrial plant, a steel mill, or a powerhouse, you've marveled to the sweep and surge of giant pistons, gushing flame, and massive wheels. You can capture those marvels on film as a permanent record of experience. Learn how to do it in the

JULY ISSUE

Popular Photography

The Leading Magazine in Photography

NOW ON SALE AT ALL NEWSSTANDS

Amazing Miss

(*Continued from page* 50)

the tables. She signed up Fred Steves for her charter work—off the Western Air Express payroll.)

One advantage of working for Union Air Service (quite aside from having such a charming boss) is the frequent departure from hum-drum flying. Bill Owens, now with American Airlines, tells a classic yarn.

"What a night!" he invariably prefaces the story. "I flew two couples to Las Vegas to get married, shepherded them through the town's night life, found them in jail, bailed them out and brought them home the next day—only to find out that . . ." Well, here's the yarn:

The two couples appeared at the airport at about 9 p.m. one evening, in a desperate hurry to get to Nevada so one of the couples could avoid the California three-day marriage law. The other couple was going along for the ride. Arrangements for the charter and the flight to Las Vegas were business-like and uneventful; it was the Nevada hospitality that gave Owens the grief. After a round of night clubs and gambling casinos, Owens finally herded his charges into a hotel and retired to his own room for much-needed sleep.

The next thing he felt was the stern hand of the sheriff prodding him awake.

"Your party is in jail—disturbing the peace," was the laconic greeting.

Bill bailed them out with the dawn and they took their chastened way to the airport and back to Burbank.

"Congratulations — I hope you'll be very happy," brightly Miss Gibson greeted the bride at the door of the plane.

"Bride" and "groom" stared at her and then at each other slack-jawed—they had forgotten to get married!

Such escapades are not rare but most airplane charters are strictly business affairs and in many cases matters of grim emergency. Such a one was Union Air Service's longest charter to date—a midnight race with death to Santa Fe, New Mexico.

Two women, one the wife of a Canadian automobile plant executive, arrived at the airport in deep agitation. Someone dear to them was ill in Santa Fe and they must get there at once. The red Waco was in the air within minutes, bound East in a furious windstorm. Plane and pilot took the passengers through in time, but the return journey required four days because of the weather.

Most unique flight on the books was also the shortest, to Wilmington, 29 miles away. "Wanna hire your plane—Wilmington—catch a boat!" gasped a man as he came running across the airport with a traveling bag in each hand. The prop was turning before the passenger was well inside the plane. A quick glance at a map showed a private field marked near the harbor. A few minutes later the plane sat down amid a herd of cows and a car was commandeered from the owner of the airport. The passenger was last to pass up the gangplank of a Matson liner Honolulu-bound.

The odd feature of that flight was that, once having left the airport, which is an "island" inside the city limits of Los Angeles, the plane never left those city limits again until it crossed the edge of the runway on the return trip!

Other, and more routine, charter trips are the impulsive dashes by wealthy folk to not-so-nearby resorts and hasty business trips by executives trained through airline travel to expect aerial transportation to *every* destination.

This "executive trade," by the way, is one of which Inez is proud, a clientele which introduces another member of her efficient little staff, the "contact man." When a Los Angeles business man becomes habituated by airline schedules to speedy, time-saving travel he is a ready-made prospect for her, Miss Gibson believes.

"He has come to regard New York as an overnight jaunt and San Francisco as an 'up after lunch, back before dinner' trip," she points out.

"Some day he'll want to go to a town not on an airline. Distaste for slower travel has been educated into him by the airlines. All I have to do is keep my firm name before him and show that I have a good equipment and competent pilots.

"The airlines are doing a swell job of educating the modern business man to air travel—I'd be foolish not to profit by it," she observes.

Thus there is a contact man for Union Air Service. He works in close harmony with airline traffic men in the event they receive inquiries about air travel off the scheduled routes. He keeps in touch with travel agents, hotel and newspaper travel bureaus, independent agencies and motion picture studio transportation departments.

"It's working out," cautiously admits Miss Gibson. "I'm not trying to create a sensation—just trying to get along. You can put this down for the record, though: I'm in aviation for keeps—for better or for worse!"

Which last phrase brought up the next question where an attractive girl is concerned.

How about marriage, Miss Gibson?

"Nix!" she says. "Marriage is out. I'm too busy. Besides, I'll never marry a pilot!"

END

Safety Valve

(*Continued from page* 38)

or of swedging, can be worked out. No doubt the high temperatures it will be subjected to will have some effect on the cable, but it should be amply strong to serve its purpose.

Preliminary patent papers were gotten out on the scheme when it was first devised, but they were allowed to lapse and anybody is welcome to do as he pleases with it.

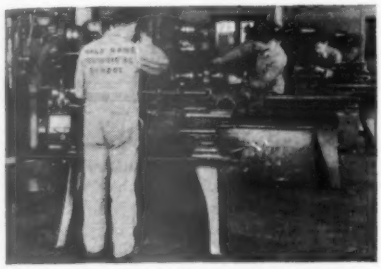
END

LEWIS HOLY NAME SCHOOL OF AERONAUTICS..

offers a complete specialized education in all phases of

AVIATION - ENGINEERING - FLYING - OPERATION MAINTENANCE - BUSINESS ADMINISTRATION

★This school has been in operation seven years and was formerly open only to boys who qualified after extremely rigid entrance tests and who maintained rigid academic standards. NOW the school is open to boys of all faiths, of high mental caliber, who wish to work hard to qualify for a lasting future in this highly specialized field. Only boys who are graduates of approved high schools and whose scholastic standing is in the top quarter of their classes will be accepted as students. They should, preferably, have majored in mathematics and the sciences but may take these studies in their first year with the freshman aeronautical college subjects. Students enter in June or September and graduate in September or June four years later. The course runs through the summer months with four weeks during each 12-month period for vacation. No effort has been spared to make this course the finest available and in setting up a school of superlative type for this specialized education.



A tremendous amount of practical experience is gained in the well equipped machine, forge, motor, and wood-working shops. A competent engineer cannot be produced without a full amount of this type of work under experienced instructors. The machine shop pictured is fully equipped with lathes, shapers, millers, grinders, drill presses, etc.

All students, if they desire, are given twenty hours of flight training with the Engineering Course. All students must be enrolled in the Engineering Course to take flight training. A complete 300-hour course is given if desired and taken over the same period as the engineering. Ships of modern manufacture, ranging from 50 to 330 horse power are used in both open and closed types.

The basic course is aeronautical engineering, for which an excess of 4500 class hours is required for the four years. This is approximately 700 hours more than an ordinary four-year engineering college course. A flight course of 300 hours is optional and includes advanced blind flight and airline procedure as a part, in modern flying equipment ranging from 50 to 330 h. p. Students must take the aeronautical engineering course to be eligible for flight training. Aeronautical instruction leads to a Bachelor of Science degree in Aeronautical Engineering. *Flight* students receive commercial licenses from the Civil Aeronautical Authority and *all* students receive airplane and engine mechanics licenses during their instruction period. When you graduate from Lewis Holy Name School of Aeronautics you are fully equipped to enter the Aviation field and measure up to the qualifications demanded by the choicest positions. Our well-equipped machine and airplane rebuilding shops give students a thorough practical training which is an absolute essential in a complete aeronautical education. The column to the right will give you more pertinent facts.

FACTS ABOUT THE SCHOOL

★ **ORGANIZATION—**
The School is under the personal direction of The Most Reverend Bishop Bernard J. Sheil, D. D., V. G., the founder of the nation-wide Catholic Youth Organization. The school is strictly nonsectarian, but under the direct supervision and control of the Catholic Archdiocese of Chicago, however, religious facilities are provided for all denominations for those students who wish to attend.

★ **LOCATION—**
The school is located in Lockport Township, 35 miles southwest of Chicago's loop and 6 miles north of Joliet on Route 66 (U. S.).

★ **TRANSPORTATION—**
All types of transportation are readily available. The normal form is the bus which includes, on its scheduled run, a stop in front of the school.

★ **ACCOMMODATIONS—**
(living) The school provides large double rooms, to which two students are assigned. The school operates its own kitchen, bakery, and laundry.

★ **FACILITIES—**
(land) The school is situated on 620 acres of land, 160 acres of which make up the airport, the remainder is given over to recreational facilities and campus proper.

★ **REGISTRATION—**
Students who qualify will be accepted in June and September.

★ **COURSE—**
The basic course offered is Aeronautical Engineering and leads to a Bachelor of Science degree in Aeronautical Engineering at the completion of four years. The course requires in excess of 4500 class hours, which is approximately 700 hours in excess of the ordinary four-year college course.

★ **FLYING—**
Each student enrolled in the Aeronautical Engineering course will receive twenty hours of flying. A flying course of 300 hours is offered as an additional elective.

★ **ATHLETICS and RECREATION—**
Ample facilities are provided for any and all types of athletics. Social functions are under the direct supervision of the faculty. Tennis courts, swimming pool, ice skating rink, baseball diamond are some of the facilities provided for recreation.

HOLY NAME
LEWIS
SCHOOL OF AERONAUTICS

LOCKPORT ILLINOIS

Located 35 miles from Chicago's loop

TO PARENTS:

If you are fortunate enough to have a son whose high scholastic standing and interest in Aviation qualifies him for entrance in Lewis Holy Name School of Aeronautics, make it your business to investigate and convince yourself that this is the ideal place for your son. You are welcome to come and inspect the school personally or the coupon will bring you complete information.

REQUIREMENTS FOR ADMISSION—
Entrance to the aeronautical course is open to graduates of high schools who have stood in the top quarter of their class academically.

LEWIS HOLY NAME SCHOOL of AERONAUTICS
Dept. H, LOCKPORT, ILLINOIS

Please send me detailed information.

Name .....

Address .....

City ..... State .....

Learn —
AIRPLANE DESIGNING

Step out of the rut-type of job into a position with unlimited future. No previous training necessary. Courses are approved by the industry and written by leading engineers.
Send for free booklet today.
WESTWOOD CORRESPONDENCE SCHOOL
57 Village Station Los Angeles, Calif.

Practical Aviation Instruction

For the layman, for the pilot, for the mechanic, and for the ground-school instructor. The transport license method of specialized aviation instruction, published since 1930. For particulars, write, enclosing stamp.

THOMPSON AVIATION PUBLISHERS
8322 Woodward Detroit, Mich.

INSTRUMENT TECHNICIANS IN DEMAND

Prepare for outstanding positions in aviation's newest branch. Learn testing, repair, installation, shock mounting and plumbing. Airline and Govt. procedure. Write for catalogue giving full details.

AMERICAN SCHOOL OF AIRCRAFT INSTRUMENTS (Dept. 6B)
3903 San Fernando Road, Glendale, California

See
WOODSTOCK
TYPEWRITERS

★

HIGHWAYS
ARE BECOMING
AIRWAYS!

★

THE drone of an airplane motor no longer causes the man on the ground to look up and stare. He takes the plane as matter of fact as the passing street car. Sometimes the heavy roar of the newest giant of the airways draws his attention, but only in admiration, and with the growing conviction that this is the way to get where he wants to go.

Keep pace with this aerial advance by reading

POPULAR AVIATION

THE LEADING MAGAZINE ON FLYING

On sale the 10th of every month

Case for 4 Engines

(*Continued from page* 31)

for Douglasses and their representatives have spent long hours aloft in the DC-4 itself. But, Santa Monica plant officials have said, nothing can be done about such negotiations for at least 60 days. That would put off the day of Dutch dickering for the DC-4 until sometime in July.

Rumors that Japan has sought the DC-4 have been vigorously squashed by Douglas executives. "We can't, won't and don't intend to sell them any DC-4's," one ranking official said flatly.

So this is the situation: about the time the editor starts correcting copy on this yarn Benny Howard—the pilot who wouldn't say die even when the Eight-Ball rolled right on top of him in the 1936 Bendix Race—will start the DC-4 rolling down the runway at Union Air Terminal, Burbank. He'll head for Cheyenne, Wyo., United's maintenance base. Then this lad who took over the controls of the world's largest commercial landplane when Johnny Cable checked out in a crash last January, will launch the DC-4 on its airline tests.

Until now, Benny has been manipulating the Douglas for the Civil Aeronautics Authority. He has dived, rolled, spun and stalled the 65,000-pounder. Once the DC-4 roared, power-on, earthward at better than 300 m.p.h. Once it hung nose-skyward in a whipstall. This is a maneuver generally reserved for fighting ships, but the DC-4 held together nobly. Now it gets a well-earned rest and goes into the humdrum of commercial route try-outs.

Next TWA—which earlier announced it wasn't even going to test the Douglas—will take over. Much of this concern's work will be done on the ground at Kansas City, Mo. Then American, Eastern and Pan American Airways.

Then? Who knows?

END

Won't Stay Down

(*Continued from page* 38)

over the town—so Chuck would hear and get the ambulance out to the field before I landed—just in case.

"After enjoying what I fully expected to be my last airplane ride, I came around to land. Hoping to kid myself into a better frame of mind, I decided to try for the fifty foot circle in the middle of the field (it looked about five inches to me at the time). Well, I hit squarely in the center of the circle, and made the nicest landing I've ever made. As soon as I could get over my surprise I complimented the ship on its ability to fly itself and taxied back up to the end of the field.

"Chuck had arrived and he darned near pumped the arm off me. Somehow I was feeling a little weak. Something I ate, no doubt."

Jack perfected the control system for his rudder and asked the Piper people to help him get a government okay. He says they took the whole matter out of his hands. There were weeks of silence and then, last fall, he got word from the Civil Aeronautics Authority that his control had been approved.

Subsequently Jack built up his solo log. He even had a couple of forced landings. He lives in a part of the middle west that is covered with jack-pine—not the best country for forced-landings, but he got away with them and didn't scratch his faithful *Cub*.

Jack's adventures just go to show that the pilot's main asset is his head. It doesn't help much to have a healthy pair of legs if the head is ivory.

Like many of the rest of us Jack has been having money troubles recently. He had to sell his *Cub* last winter and he's without a ship now—but we can't keep him down. He expects to be flying again soon.

END

Airy Chat

(*Continued from page* 8)

as he has been lately, "on an inspection tour". He's supposed to be making a vital survey of Uncle Sam's military aviation situation followed by a super-authoritative report thereon. That report, of course, was supposed to have been the all-powerful proof that Congress needed before approving many millions of dollars for new military aircraft.

We're inclined to wonder how *any* man, after four years in several European "hideouts", suddenly can return to the United States, fly around the whole country in seven days, then tell Washington officials just what to do and what not to do about our air force. There are thousands of Army, Navy and airline pilots—not to mention the many other experts on the ground—who know far more about American aviation than Colonel Lindbergh will ever be able to absorb. Frankly, we think it's quite obvious that the Army used him as a publicity-getting "front". Which is probably all right, considering the fact that it takes that sort of hokum to impress the average politician. What we think decidedly unnecessary, though, is the expenditure of public funds for Colonel Lindbergh's much-publicized junket around the country in "his" shiny, new Curtiss P-36 fighter. What could he possibly have told Air Corps officers about our air force that they didn't already know?

* * *

FRANK HADESBECK just happened to drop us a note saying he'd returned from Spain. We came near passing him up, what with dozens of legitimate and would-be "pilots who flew in Spain" wanting to get their experiences into print. But when we saw the little-described anti-aircraft facts and figures we grabbed them. They are on page 10 and Mr. Hadesbeck is taking it easy up in Canada.

* * *

HOLLYWOOD's movie pilots were a bit put out over "Hollywood Hokum" in the April issue. They—in the person of Paul Mantz, generally considered the group's ringleader—voiced a heated objection. As a matter of fact, Mr. Mantz

(*Continued on page* 85)

"Expert — for the professional . . . Simple — for the layman."

THESE ARE THE BOOKS THE AIRMEN USE to make themselves BETTER, SAFER FLIERS

PUBLISHED with the stamp of approval of leading figures in the entire aviation industry, this comprehensive, practical, 2-volume aviation library has been hailed with delight by men who pilot, build, maintain, or dispatch airplanes. Simply written and lavishly illustrated, these books give you modern flying from the ground up—from basic principles through the latest technical developments of instrument flying, in words and pictures. They are written and illustrated by experts. Both are yours, boxed, at an amazingly low price.

by ASSEN JORDANOFF

Pilot, instructor, engineer, technician and technical adviser to leading American airlines and manufacturers since 1921.

YOUR WINGS *The Manual of Flight*

A FAMOUS book on the art of modern flying, which has, in less than two years, been translated into 7 languages, and been bought and used by tens of thousands of aviators in France, England, South America, Russia, Central Europe and the Far East. Thousands of copies now in use at the new Tennessee State aviation schools. Standard text in leading aviation academies throughout America. *Over 400 illustrations.* Size 7" x 9½", 281 pages.

THROUGH the OVERCAST

The Weather, and the Art of Instrument Flying

C. R. Smith, President of *American Airlines, Inc.*, says: "This book has taken the subject of meteorology out of the mathematical equations and has made it simple enough so that the average person can understand it. In addition, the author has explained instruments, as well as radio and all allied subjects, through a series of pictures, so thoroughly that it will help not only the professional airmen, but the fledglings as well to grow bigger and faster wings."

Over 300 illustrations make everything crystal clear in this book—the first complete and practical work on what has been incorrectly called "blind flying". Experienced pilots have hailed it with delight, because it gives in words and pictures accurate descriptions of the function and use of all the wonderful new instruments that are just now being installed in planes to make flying better and *safer*. Size 7" x 9½", 356 pages.

A PRACTICAL COMPLETE AVIATION LIBRARY IN 2 VOLS.

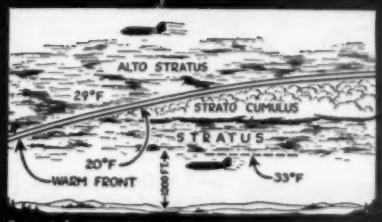
Everything from basic principles of flying through the newest developments in navigation, meteorology, engines, instruments, radio, aerobatics, instrument flying, military and scheduled airline aviation — completely described in *words and pictures*, by experts.

TOGETHER, BOXED, ONLY

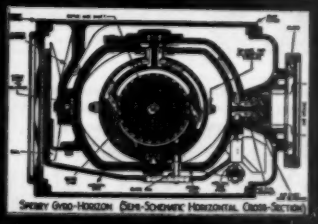
$5.00 *Indexed Illustrated*

You pay nothing if not satisfied.

HUNDREDS OF EXPERTLY DRAWN PICTURES LIKE THESE SHOW YOU AVIATION'S EVERY SECRET



Scores of meteorological drawings explain clearly the behavior of weather and the safe levels for flying under every possible weather condition.—From THROUGH THE OVERCAST.



Cross-section of Sperry Gyro-Horizon, showing all important parts.—One of dozens of pictures of the latest Sperry, Kollsman, RCA, Frieze, and other instruments, from THROUGH THE OVERCAST.

Graphic step-by-step representation of a flying maneuver.—One of hundreds, from YOUR WINGS.

STUDENTS! These books will help you save money... Shorten your dual time instruction... Prepare you for the tests for all grades of Federal licenses.

☞ Either *Through The Overcast* ($3.00) or *Your Wings* ($2.50) are available singly from any bookseller, Air Associates, Inc., or from the publishers at the above prices per volume. See coupon at right for special mail offer. ☜

SEND NO MONEY

Just sign and mail coupon. When books are delivered pay the postman only $5.00 plus a few cents carriage charge. Examine the books ten days. If, after you have seen them, you are in any way dissatisfied with them, you may return them, and your money will be cheerfully refunded.

Tear out, sign and mail to
FUNK & WAGNALLS COMPANY
Dept. 1982 354 Fourth Ave., New York, N. Y

Send me the books I have checked below. When the postman delivers them, I will deposit with him the price indicated, plus a few cents postage. I understand that if I am in any way dissatisfied, I may return both or either of these books within 10 days for full refund of purchase price.

☐ **THROUGH THE OVERCAST and YOUR WINGS, boxed, $5.00.**

☐ Through the Overcast, $3.00. ☐ Your Wings, $2.50.

Name.....

Address.....

City & State.....

NOTE: Check here ☐ if you enclose remittance with order, in which case books will be mailed post free. Same return privilege applies.

Now Only $5.00
REAL ENGINE VALUE
Over 7,000 GHQ Gas Engine kits were sold at $8.50. Over 10,000 sold last year. Now is your chance to buy the New Improved Kit for $5.00. Absolutely complete with coil, plug, etc. Send only $1. Shipped Exp. Coil, for balance same day. Send 3c for new 12 page illustrated catalog.

All Parts Guaranteed
A1/5 H.P. For Boats, Planes, etc.
All machining done. Only a screwdriver needed. Average assembly time 30 minutes.
GHQ MOTORS, 854P East 149 St., New York

YOU CAN BUILD A MODEL AIRPLANE THAT FLIES 2 MILES
THE ORIOLE $1 POST PAID
50" WINGSPAN
COMPLETE MATERIAL AND INSTRUCTIONS with many finished parts, including propeller and wheels. EASILY BUILT IN A FEW HOURS.
SCIENTIFIC MODEL AIRPLANE COMPANY
DEPT. Y, 218-220 MARKET ST., NEWARK, N. J.

New Seco Double Duty Signal
SECO not only makes your stop lights flicker, but also makes them automatically show decreasing speed of car because it is positively driven by speedometer cable—no thermostats. Easily attached. Send $2. Mention car and year. SECO Triple Duty Alternating Signal $3. Money Back Guarantee. Smith Engineering Co., Buffalo, N. Y. Territories available.

A Brand New Magazine
SECOND ISSUE..FEATURING
EDGAR RICE BURROUGHS
Master of fantasy and imaginative fiction. Read his latest novel—
THE SCIENTISTS REVOLT
Plus five other fine stories and many entertaining features, in a magazine designed to please the discriminating fiction reader.
NOW ON SALE AT ALL NEWSSTANDS

I Learned About . . .

(*Continued from page 36*)

first almost fatal moment when I started to go to pieces and to give myself up to the undertaker. I've faced what I've had to face and I've always managed.

In my case, there wasn't time for any particular schooling in remaining calm. But schooling is possible. One way to get it is to invent situations which might face you as you fly along and figure out exactly what you'd do in a cold, calm manner. Imagine yourself having a motor failure on a dark night. Watch your altimeter, release your flares, adjust your safety belt and ride it down. Or watch your motor fall off. Your tail goes heavy. You pull it level by pulling your stick into your stomach as you start flying backwards. The tail stalls and drops and you come down that way. In my barnstorming days I knew a devil-may-care fellow with a calm head who lost his motor at 1,500 feet over a thickly populated town. He rode the ship down on its tail into a vacant lot between two buildings and walked away from the crash with his passenger. He told me later that he had reasoned out the performance of his ship in the first second, that he never lost control—and that he spotted it into the lot. I'd flown with him for years, flew with him for more years after that, and believe he was telling the truth.

"I'd figured it out one time in my mind and I just kept my head," he told me.

"Figuring them out" is a ghoulish pastime, but it helps meet emergencies. It helped this pilot. However, most important of all, he didn't give way to momentary panic or he'd have washed himself out, just as I would have. I've often wondered what happened to certain pilots I knew who got into trouble and didn't get out. I'm inclined to think they lost their calmness just when they needed it most. It is normal and must be guarded against.

Drill yourself, impress upon your subconscious mind that you will keep possession of every faculty when you need them most. If you do, my first experience taught me, the chances are overwhelmingly in your favor. Lose your head and they're all against you.

END

Almost Beat Wrights

(*Continued from page 48*)

clamor for action. Cannon was goaded frequently for his failure to make the contraption work. Eventually funds gave out, additional backers were wary of further risks, so finally, in desperation, Cannon realized the venture had to be abandoned. The strange machine was lowered from its foundry loft position with a hoist and placed on a waiting flat car. With its departure Pittsburgers drew a sigh, a sigh mingled with relief and sadness and then the town settled down to the business of harvesting its yam crop.

END

Meet Mr. Wilson

(*Continued from page 43*)

The next step came soon after he flunked his second air mechanic's exam. (He was too sure this time of lubrication systems and brakes and instruments; they were featured in the exam.) Somebody told him he was disrated as Specialist 5th Class. A bit worried, he found the rumor to be true, but found he had also been promoted to Private First Class. Well, ain't *that* something! Two years and a "P.F.C." A long way from the top, but still climbing right along with the rest of them.

Another day, another list. He was third on the Technical School eligibility list and—the squadron got three vacancies, one for his course. Tom was discharged "for the convenience of the Government" and re-enlisted for three years. Too many men, with short service left had taken the course and then not re-enlisted, leaving the Air Corps a loser, some factory or airline the gainer. The Squadron Commander called them in before the three of them left in an Army transport plane for the school in Illinois. Hoped they'd be a credit to the squadron *and* that they'd return to find more and bigger ships in the hangars. And more ratings. Good luck, etc.

Monthly Pay and Allowances

PAY

Master Sergeant	$126
First or Technical Sergeant	84
Staff Sergeant	72
Sergeant	54
Corporal	42
Private First Class	*30
Private	*21

*Plus from $3 to $30 if they hold a specialist's rating.

EXTRAS

Board, uniforms, medical attention:
Air Mechanics:
1st class get $84.
2nd class get $72.
If not an air mechanic, may get 50 per cent extra pay when on duty requiring flights.
Top three grades get quarters if married.
For every four years' service, pay is increased five per cent (Staff Sergeant with 20 years' service gets $90).

For the first couple of months, Tom, enrolled in the Airplane Mechanics' Course, marvelled at the *un*scientific method of working to which he had become accustomed. Trouble shooting on engines for one. Here it was a science. No hit or miss. The instructors were civilians and non-coms; he watched them even more closely than he had watched Scotty; who wasn't near as perfect in his technique, Tom soon realized.

Nine months later, graduation certificate pasted inside the lid of his trunk locker, he was back in the old squadron. New men coming from the school while he was there had pre-

(*Continued on page 87*)

Airy Chat

(*Continued from page 82*)

got so voluble on the subject (as you will see on page 20) that Correspondent Churchill went to work on him. With excellent results.

* * *

IT never dawned on us that so many people would be interested in POPULAR AVIATION's circulation figures as compared to other aviation magazines. So many folks in the aviation industry have asked us the same question that we'd better include it here for everyone to see. Rather than offend the other publications, we'll not mention their names. But the figures on all of them—including POPULAR AVIATION—come from the Audit Bureau of Circulations. Average monthly circulation for the period ending December 31, 1938, was as follows: POPULAR AVIATION, 63,054. Magazine A: 30,983. Magazine B: 24,675. Magazine C: 10,923. Magazine D: 10,202. That group includes *all* the better-known trade publications.

* * *

THE Piper Aircraft people were so impressed with what they knew of Jack McMahon's story (page 37) they wrote us about it. A letter to McMahon brought an encouraging reply worthy of the concentrated efforts of a P.A. correspondent. The results were well worth it.

* * *

LACK of business ability coupled with downright laziness is, more than anything, responsible for private aviation's doldrums today. It is our fond hope that someone with the abilities and force of a Ford or Kettering will decide to make a business out of catering to and dealing with the private flyer. Then—and, we fear, only then—will the industry wake up and go to work. Today many private plane manufacturers—none of whom are overly well off—treat prospects in the same deplorable manner they did back in aviation's halcyon days. We ourselves turned over quite a few prospects to certain lightplane manufacturers during the past five or six months. Each prospect was enthusiastic to the point of writing a check on the spot. How well did the manufacturers follow up on their business? Well, *not one* of those prospects was called on *once*. A great many airport operators are just as bad or worse. They have absolutely no conception as to how they should seek new business. They treat airport visitors—every one of whom deliberately go out to their local airports to see what that operator has to offer—like a bunch of pimple-brained hoodlums. Too many airport operators are at their best with their feet propped up on the inevitable kerosene stove, complaining alternately about the lack of business and the "dirty dogs in the Civil Aeronautics Authority" who heap regulation after regulation on the poor operators' weary heads. Apparently it's never dawned on those "airport gophers" that they're entirely to blame for their own condition.

* * *

Is there a doctor in the house?

M. K.

It's Not All Hokum!

(*Continued from page 66*)

Maybe the bomber in "Men With Wings" *was* a Boeing 247D and didn't have the windows closed off and didn't have guns mounted on it. The director had figured on getting a genuine Martin which the bomber was supposed to be, had been turned down and couldn't build one on the field. Besides, most bombers are passenger ships first and are converted later. For instance, the present Lockheed bomber, of which we sold 250 to the British, is a modification of the original Lockheed "14."

Mantz, in order to handle his various motion picture aviation jobs, holds one of the most complete pilot-rating lists in the country. His license qualifies him for 2S land, 3S land, 3M land, flight instructor, instruments, 3S water and 4M land and water. His safety record is unusual. The only time he ever has damaged a ship aside from deliberate motion picture crack-ups was recently when he landed a Lockheed on a plateau in Utah and broke an axle. So inaccessible was the field and so difficult was it to even land in, that the instruments and motor were taken from the ship and it was left there.

The movie pilots are still working at the same old stand, giving heroism instead of hokum, risking their necks to thrill themselves and you in the audience—and they love it!

END

AID TO

PILOTS

ONLY $1.00

YOU MUST UNDERSTAND

THE NEW CIVIL AIR REGULATIONS

AID TO PILOTS, a new hand book that you should have, written and compiled by C. Earl Steele (author of Aviator's and Mechanic's Hand-Book—and formerly with the Civil Aeronautics Authority). This pocket size manual gives all classes of pilots the essentials of the Civil Air Regulations on the requirements for student, solo, private, limited commercial and commercial certificates, with questions and answers. Covers contact, instrument and night flight on and off airways, airport control, airway traffic control, and traffic control limitations; Green, Amber, Red and Blue Airways, control zones, plus an easy method for remembering required altitudes. Service flyers will find this a valuable asset. Written in language you can understand, this pocket size reference will be sent postpaid for $1.00—MAIL THE COUPON TODAY—YOU WON'T REGRET IT TOMORROW.

AID TO PILOTS

4134½ Marathon Street, Dept. P, Los Angeles, Calif.

AID TO PILOTS,
4134½ Marathon St.,
Los Angeles, Calif., Dept P

MAIL NOW!

Please send me, postpaid, a copy of "Aid to Pilots," for which I enclose $1.00.

NAME.....

ADDRESS.....

CITY.....STATE.....

Print Name and Address Clearly to Insure Prompt Delivery

SOLO COURSE ABSOLUTELY FREE

A solo flying course with traveling expenses paid to and from St. Petersburg will be given to a number of our students absolutely free. Our Home Study Courses completely cover Flying, Airplanes and Engines, Aerodynamics, Navigation, Meteorology, etc. You do not have to take the entire group of courses to be eligible for our Free Flying Course. Write today for free literature.

GULF CORRESPONDENCE SCHOOL
2728 1st Avenue South
St. Petersburg, Florida

NOW! World's Smallest Real Performing RADIO
BEAUTIFUL PLASTIC CABINETS

Midget radio fits your pocket or purse. Weighs only 4 ozs. Smaller than cigarette package! Receives stations with clear natural tone. NO CRYSTALS to adjust—NO UPKEEP—only one moving part. "AUDIOPHONE" gives superior performance. ENTIRELY NEW PATENTED DESIGN. Has enclosed geared luminous dial for perfect tuning. MANY OWNERS report amazing reception and distance.

ONE YEAR GUARANTEE
Sent complete ready to listen with instructions for use in homes, offices, hotels, boats, in bed, etc. TAKES ONLY A SECOND TO CONNECT—NO ELECTRICITY NEEDED!
SEND NO MONEY! Pay postman only $2.99 plus postage on arrival or send $2.99 (Check, M.O., Cash) and yours will be sent complete postpaid. A most unusual value. ORDER NOW!
MIDGET RADIO CO. Dept. PA7 KEARNEY, NEBR.

AVIATION APPRENTICES

AIRMINDED YOUNG MEN INTERESTED IN TRAINING FOR ENTERING THE WELL PAID FIELD OF AVIATION AS APPRENTICES—Write immediately, enclosing stamp.
MECHANIX UNIVERSAL AVIATION SERVICE CO.
Wayne County Airport Box 857 Dept. B Detroit, Michigan

LAUGHING AT WAR

Arthur R. Tofte, noted science fiction writer, presents one of the cleverest, most delicate satires since "Idiot's Delight" in

WARRIORS OF MARS

Don't miss his subtle jest at the Gods of War, woven into an entertaining and significant fiction story. It's a feature novelette, heading a great list of fine imaginative stories created to provide true entertainment and relaxation.

SIX GREAT STORIES

plus a wide variety of entertaining articles, all complete, in the

AUGUST ISSUE

AMAZING STORIES

On Sale Now At All Newsstands

10 Goal Pilot

(*Continued from page 56*)

three miles around and officials have asked the commuters to install radios in order that they may keep in touch with the control tower. Hitchcock and other air-commuters have requested permission for a "tunnel of air" in this controlled area. They would like to have this passage about two miles from the airdrome and about 500 feet up.

"We figure the transports will be well above 500 feet at two miles," Hitchcock explained, "and that we can get through without difficulty keeping in contact, of course, with the control tower via radio."

Hitchcock uses the transport lines whenever the occasion demands and he looks upon flying as a utilitarian proposition rather than as a sport or a diversion. At the moment he's vitally interested in a commercial aviation proposition described, coincidentally, elsewhere in this issue: American Export Airlines. He is one of the "guiding lights" of that newborn organization and just what part he has played in the development of AE is described in the article which starts on page 12 in this issue . . .

When the day's business is over at his office, Hitchcock takes a five-minute walk over to the skyport, gets into his plane which the pilot has ready and waiting, takes over the controls and within 15 minutes he's at the beach in front of his house and in another few minutes he's up on one of his favorite polo ponies.

Flying? Useful and convenient. Tommy Hitchcock has the calm, matter-of-fact attitude toward it which thousands, who have never even been in a plane today, will have tomorrow.

END

Light That Failed

(*Continued from page 46*)

quarter, fearful that peepers other than his would be first to sight the running lights. The entire ship was bristling with anticipation.

The stage had been well set by 10 p. m. Group singing had been organized. A crowd of drunks practised American college yells. Suddenly someone shouted he had sighted a light, pointing low on the horizon in the expected direction.

Ruction immediately became rife. The patriotic stewards waved sheets and pillowcases. Passengers jumped, screamed and embraced. Nelson, in youthful fervor, took one look and then rang bells, whistles and the ship's siren. Luckily, he forgot the control switches of the sprinkler system. The passengers took the noise from the bridge as official greeting and when the light blinked, as if in response, the hysteria increased.

The Captain called to the bosun to paint longitude so-and-so on the hatchcover. The bosun, however, slipped in chauvinistic haste. When the spotlights came up, they illuminated a sad scene. A gallon of flat white had been splattered over the previous lettering, and the bosun, bucket and brush still in his hands, lay on his back to curse—too enraged at fate to get to his feet. The lights were promptly extinguished to save electricity.

Meanwhile, an American Naval officer, whose aplomb during the wildness was a contrast, made his way slowly to the bridge. Bending over to knock his pipe on his heel, he asked:

"You boys ever seen Jupiter rise before?"

The Fourth adjusted the lapels of his uniform coat indignantly, and ordered him off the bridge.

But Jupiter it was! Masters-at-arms were sent among the passengers to explain the difference between a plane and a planet. Even then, many insisted they could hear the motors growing louder and one man, carried along by the momentum of mass hysteria, said he could copy, in Morse code, what the light was signaling. Then, we received word of flight's postponement just before midnight.

Young Nelson was relieved of his watch at eight bells, but not of his worries. He made his way sadly to his cabin, and found, pinned to his pillowcase, a note from his fellow officers:

"Twinkle, twinkle, little star,
How I wonder what you are;
Up above the world so high—
Like an airship in the sky!"

END

"Shorty"

(*Continued from page 68*)

He'd been warming his eyes for this, but after giving him a glimpse of the ground while he was still 40 feet in the air they rolled back in his head. He held the plane straight, kept his flying speed and finally the wheels touched. It was the first truly blind landing in history.

Shorty left the Army for the insurance underwriters' laboratories as aviation engineer, then went to the Ford Motor company, where he ran Henry Ford's airline and played the biggest part in developing the great Ford trimotor planes. He left Ford and became operating head of the Curtiss-Wright school in Chicago. Things moved slowly until 1933 when Shorty went to the old Bureau of Air Commerce in Washington. There for a while he alone prevented rank chaos in the aviation industry because Government, it then appeared, had determined to break every airline carrier. In 1937, Shorty resigned to become a vice president of United Air Lines, where he is today. He's been placed in charge of airline safety, and is back working with the stratosphere for the company is preparing to buy the DC-4, a stratosphere airliner with a pressure cabin for high altitude flying.

Twenty-nine years he's been working at flying and flying problems. He sees as many ahead as have been solved in the past and thinks this is healthy, for he says:

"A few fleas on a dog keeps him scratching." END

Meet Mr. Wilson

(*Continued from page 84*)

pared him for the changes. (Dutch never wrote a letter in his life, although he'd promised to.) Lieutenant Dollivar was now *Captain* Dollivar and was Operations Officer. There was a new Squadron Commander. Master Sergeant Fells had retired after 30 years' service. Scotty had gone to the Philippines. Another staff sergeant was out and had gone with the Bureau of Air Commerce. A few had gone out, not re-enlisting. And two things were coming up—another maneuver and an air mechanic's exam. He was sure of the latter when he took it but was back from maneuvers before he knew the official results. He had often thought of the big jump to $72 a month when and if he ever made air mech second class but now he was a *specialist* second class and each month was handed 55 berries, plus a slice of flying pay, less "deducts for jawbone" and the monthly two bits for the Soldiers' Home. He was also Crew Chief, the youngest in the squadron, but not in the group. Never got a *serious* skin from the mechanical inspector. Life was pretty rosy, until———

They were climbing out of a field in formation when the left motor died suddenly. The pilot dropped the nose, slammed full throttle and high prop r.p.m. on the good engine and turned back. In the emergency he started the wheels down too late, they were still lowering when the ship hit, slewed around and rested on its belly.

Now what? No, no one was hurt, except maybe one guy Wilson's neck was in a sling if engine failure was his fault. Whether it was or wasn't he promised himself he'd never skimp. It was a broken camshaft, apparently no one's fault, but the incident stuck with him for many a year as to "what might have been".

A month later Tom was rated an air mechanic second class to fill a vacancy. No more guard duty! A little over a year later—on his 25th birthday and the squadron organization day barbecue party—the Squadron Commander officially announced Tom's promotion to air mech first class to the assembled outfit.

Down near the barbecue pit some of the invited officers were singing. A Lieutenant Smith, an ex-high school classmate of Tom's, gave him a grin and started a verse of that song, "Come On And Join the Air Corps"———

"———our air mechanics have more brains
Than generals of the line———"

The Squadron Commander, dignity relaxed for the occasion, gave Tom a wink. "You wouldn't dispute the word of an officer, would you?"

END

Flying Through College

(*Continued from page 62*)

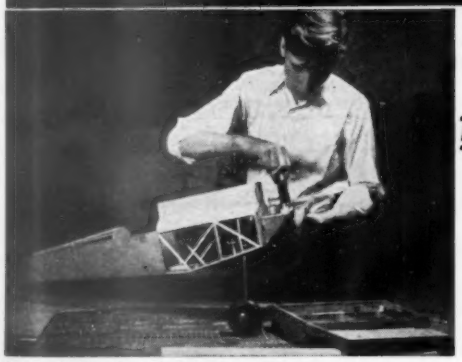
Which is a typical airman's answer, accompanied by a typical airman's glance. It's one thing to play hop-scotch with trees at an altitude of 15 feet in light so dim that ordinray eyes might not see the trees. But it's an entirely different thing to fly through the air with about 22 hands grabbing frantically for your neck. And the physician knows full well that the human body will not stand things at 30 which may be laughed at at 22.

Phillips isn't well-known about the university. He has a big job and a heavy course in study. He has only a short time each afternon to work with his own students. He has little time for anything but study and teaching. His instruction ship is a *Cub*.

His base of operations in schooling is the Fayetteville municipal airport—and cities of 9,000 in the hill country do not have ports with paved runways. It's wet when there's rain and there are no lights. But it's flat and usable and there's not enough traffic to kill the grass, so there's not much dust. Which is enough, with 12 paying students, for the flyer to get through school on so that he can fly into the work of a practicing physician. It's a big order for flying and the flyer.

END

Keep in touch with AVIATION!



Get acquainted with this exciting sport. Know model building and model flying. Aviation is today's greatest international force. Keep in touch! You can make the latest models—have your own workshop like the one shown at left. Keep closer to live-wire aviation—

READ MODEL AIRPLANE NEWS

FUN Enjoy fascinating stories about the world's greatest aces—the fastest planes. Know about up-to-the-minute model flying. Watch your OWN miniature ships climb sky high and glide home for perfect three point landings.

KNOWLEDGE Build gliders, endurance flyers, cabin planes, pursuit ships, bombers. Know about lifting force, wing stress. Understand miniature gasoline motors—have your own gas powered job that will fly 25 minutes!

MONEY MAKING Win Model Building Prizes and Flying Awards. Make realistic, exact scale models and sell them for gifts—for home decorations, etc. Earn while you learn this exciting aviation business.

POSSIBLE CAREER It's wise to keep in close touch with AVIATION—the world's fastest growing business. Flyers, mechanics, technical experts and executives who *know* AVIATION get the best jobs and the biggest money.

FREE KIT

Complete outfit to build this 18" Endurance Model Flyer given with each yearly subscription during this special offer. Includes all materials, full size drawings, instructions for building and flying.

MODEL AIRPLANE NEWS

now in its TENTH YEAR, is published for men and boys interested in practical aviation. The editors are experienced technical experts. They furnish you the latest, exciting developments from leading builders all over the world. Many contributors are World's Record Holders. MODEL AIRPLANE NEWS gives you 64 big pages each month—packed with dozens of new models, hundreds of photos—news of the best flyers and builders. That's why model builders in 55 countries rely on this magazine for accurate, up-to-date information in the model airplane industry. It is the best way to **keep up with AVIATION.**

20¢ PER COPY AT ALL NEWS STANDS

SPECIAL SUMMER SUBSCRIPTION OFFER

12 MONTHS $1

Offer expires Aug. 8th

MODEL AIRPLANE NEWS PA
551 Fifth Ave., New York, N. Y.

For the enclosed $1 please send me Model Airplane News for one year and the FREE Endurance Model Kit.

Name .....

Address .....

City .....State .....

This offer good in the U. S. and Canada. Canadians please add 10c to cover kit mailing costs. Offer, excluding kit also good in U. S. pos., Cuba, Mexico, Panama and S. Amer.

Classified Advertising

RATE: 8c PER WORD — FIRST 15 WORDS $1.00

AIRPLANES — SALE OR TRADE

WILL TRADE: '38 Pontiac and cash for light monoplane or biplane. A. Archambault, 1000-16th St., Rock Island, Ill.

"90" AIRCOOLED WRIGHT, MOTH Biplane, Airwheels, Airspeed, Bank Indicator, Licensed. $575. Allison Aircraft, Lawrence, Kansas.

AMERICAN EAGLE, long nose, Millerized OX5, new Sensenich prop, built in spinner and aluminum cap, 8/50-10 Goodyear wheels and tires, duals, two-tone high gloss finish, fabric good, no time since complete overhaul. Licensed till April, 1940, price $475.00. Jack Bright, Lehighton Airport, Lehighton, Pa.

SECURITY AIRSTER—Kinner 100. Two place side by side open or closed, folding low wing monoplane. Licensed to April 1940. Must sell. Best buy in 28 class. $1,000. Canfield Flying Service, Williston, N. D.

OX TRAVELAIR A1 shape, fabric like new. Motor 20 hours since major, $290.00. Cals Station, Nevada, Iowa.

AMERICAN EAGLE "EAGLET", two place open monoplane, very little time since overhaul, excellent condition throughout. Just relicensed $325. Norman Gowen, Wells, Maine.

AERONCA LOW WING: 85 hp. LeBlond. Licensed until March 1940. Ship and motor in A-1 shape. Motor just topped. Total time 385 hours. Price, $1,275. Special paint, cream trimmed in red. Chas. H. Huff, Jr., Route 3, Smithsburg, Maryland.

FOR SALE: 1937 Cub. Excellent condition, $850.00. A. G. House, 333 S. Limestone St., Lexington, Ky.

SALE: Heath B-4 with metal prop. Also Lawrence 32-HP cheap. C. Kotan, 10829 Calumet, Chicago, Ill.

WANTED TO TRADE: $150 cash for a licensed plane. Carl L. Peterson, Route 1, Guthrie, Minn.

FOR SALE: Heath V with B-4 motor. Edward Pitts, 1321 Kenyon St. N. W., Washington, D. C.

WILL TRADE complete Bell & Howell eight millimeter movie equipment for a two place light plane. A special F 1.4 focusing lens goes with this four hundred dollars worth of equipment. I have the latest. Bell & Howell makes most of Hollywood's equipment; make your own movies in theatrical style! What kind of ship will you trade? C. P. Riepl, 4112 South First Place, Milwaukee, Wisconsin.

CHALLENGER ROBIN, SHIP recovered and motor majored, starter, tail wheel, radio, landing lights, bank and turn, rate of climb, generator, blue and silver, $850.00. Ringel Flying Service, Peoria, Ill.

CUB SPORT J-3: Yellow, Continental A-40 motor, 150 hrs. total tail wheel, carb. heater, perfect condition, never damaged, can finance. Price, $950.00. Ringel Flying Service, Peoria, Ill.

REARWIN SPORTSTER, LeBlond 70; 1936. Perfect condition, standard equipment plus brakes, compass, speed ring, and carb. heater, never damaged, licensed to May 1940. $1150.00. Ringel Flying Service, Peoria, Ill.

WANTED: Licensed 36 Cub or similar ship round, $450.00. Arnold Sattler, Baggs, Wyo.

SALE: Trade or pay cash. Have J-6-5 with propeller. Have all types of violins, will guarantee. Wanted Curtiss Robin or lightplane in trade in. Joe Shurley Violin Shop, 8 State St., Hartford, Conn.

MODEL A. Ford Pietenpol DeLuxe 32 foot wing. Corbin converted motor. Split gear V struts. Flying. $175.00. Pete Smith, 4445 Laclede, St. Louis, Mo.

WACO 9, $45, needs work; Heath, $50 complete; Flying Flea, $30 less motor; Robin, $75 less motor; Pietenpol, $100 flyaway. More than 100 other bargains located everywhere (not Athens). Send 25c for complete directory. Used Aircraft Directory, Athens, Ohio.

CONCENTRATION!

Wanted—1935 Waco F. Good condition and licensed. John Doe, 1313 Masterson St., Philadelphia, Pa.

The attention of over 63,000 POPULAR AVIATION readers will be concentrated on the above classified advertisement. John Doe's ad will reach the Largest Aviation market ever concentrated between two covers. It is **your market**, and this classified section is **yours to use if you have anything to sell, barter, or buy that would be of interest to aviation enthusiasts.**

The low economical rates are only 8c per word or the first 15 words for $1.00. Write now to

The Classified Advertising Mgr.

POPULAR AVIATION

608 S. Dearborn St. Chicago, Illinois

AIRPLANE ENGINES

LeRHONE, NEW AIRCOOLED, 80 horsepower motors. Weight 285 lbs. Complete, $75. Allison Aircraft, Lawrence, Kansas.

FOR SALE: Szekeley, 38-HP, excellent, cheap, with hub. Warren Krenke, Bedford, Ind.

AIRPLANE PARTS AND PLANS

SALE OR TRADE: Built ribs or kits for Heath Ski-Scout, or others. Ice Sled props. Stamp for price list. Brazil, 314 Sandercock, San Louis Obispo, Calif.

LIGHTPLANE OWNERS: Buy a spare solid rubber tail wheel tire wholesale now. Price until July 1, $2.00 each. 6x2 sponge centers. Send postcard, C.O.D. shipment. Satisfaction guaranteed. Heath Company, Benton Harbor, Mich.

TAIL WHEEL ASSEMBLIES, latest steerable or full swivel types, all light airplanes. Complete with 6x2 solid rubber sponge center type. Steerable, $14.95; swivel, $12.95. Tires only, $2.00. Satisfaction guaranteed. Wire or drop a card for C.O.D. shipment. Heath Company, Benton Harbor, Mich.

DETAILS TWO SPORT PLANES, 10c. Nimmo Aircraft, Box 27, Dept. P., Santa Monica, Calif.

WANTED: Set of completed model V Heath wings. Herb Scudder, Churchville, N. Y.

BOOKS

USED Aeronautical Books bought, sold, traded. Save money. Write S. S. Balsam, 2121 Foster Ave., Brooklyn, N. Y.

CAMERA FANS—ATTENTION! $10 to $50 a week with a Kodak. Sell your snapshots to publishers. They pay from $1.00 to $10.00 for each photo they can use. Thousands of dollars are paid yearly to Amateur Photographers. Only 25c in silver for Glen Holt's famous booklet, "Hundred Best Markets for Your Photographs." Contains 100 publishers who buy photos, the kind and other valuable selling information. Starcrest Co., 1627 Foley St., Alameda, Calif.

GETTING A JOB IN AVIATION. By Carl Norcross. 374 pages. Describes all jobs in the field of aeronautics, opportunities, requirements, etc. $2.50. Book Dept., Ziff-Davis Publ. Co., 608 S. Dearborn, Chicago.

INSTRUCTION

AIRCRAFT BLUEPRINT and layout course. $1 per lesson. Craft School, Box 687, Santa Monica, California.

AVIATION APPRENTICES: Training for entering Avation as Apprentices—write immediately, enclosing stamp. Mechanix Universal Aviation Service, Wayne County Airport, Dept. B21, Detroit, Michigan.

OPPORTUNITY to get in aviation. Will exchange complete flying course, for late model used car. Congressional Airport, Rockville, Md.

GRADUATE AIRPLANE MECHANICS. Ten weeks, $1.00 week! Graduates with leading concerns. Free catalog. United Air School, Elgin, Ill.

OPENING, limited number of selected young men with $180.00, work board, balance flying time, radio beam, blind flying, aircraft radio license, commercial license. Noll Flying Service, Bellefonte, Pa.

HOW TO LEARN FLYING without money. Folder, dime. Ohmeyer, Box 391-F, Hempstead, N. Y.

MISCELLANEOUS

"AERODRIVE" Shallow Draft Boat. Blueprints, $1. Aircooled motors, $75. Circular, 10c. Allison Aircraft, Lawrence, Kansas.

DISCARD GLASSES: Army, Navy, Airlines require 20/20 vision. $3.95 complete system, normalize defective vision, weak, near and farsighted eyes. Also prevents defective vision. Necessary every pilot, cadet, prospective flyer, students. No C.O.D. G. Benco, 1120 E., Fletcher St., Philadelphia, Pa.

GIANT 32" assembled silk parachute $1.50. Airline travel insignia (supply limited) for car or luggage 30c. Blackburn Aircraft, Burlington, Wisconsin.

SALARIED POSITIONS—$2500 yearly and up. Our confidential system (hiding your identity) serves to increase your salary; promotes you for salaried executive positions at moderate cost. Write for valuable information No. 24 Executive's Promotion Service, Washington, D. C.

FLY the New Aeronca "Chief," from $4.50 per hour. For details call Edwards Flying School, nearest to World's Fair: Flushing, Long Island, Airport. Phone Independence 3-4843.

AIRPLANE DEALERS WANTED: It is easy to own a record-breaking Aeronca "Chief." Inquire Edwards Flying Service, Aeronca District Manager, at Flushing, Long Island, Airport, nearest World's Fair. Phone Independence 3-4843.

MEAD GLIDER excellent condition, $65. Also two wheel landing gear for same. Write John Furey, Susquehanna, Penna.

DREXEL—Candid type camera, genuine ebony black case with metal trim. Super speed lens. Fixed focus. Eye level view finder. Shutter stops. Takes 16 pictures on 127 film. Bargain, only $2.39 postpaid. Harrisville Specialty Co., Harrisville, R. I.

PROPELLERS for airplanes, ice sleds, snow sleds, air drive boats. Each type a special design, with each propeller an unconditional satisfaction or money back guarantee. Catalog, 10c. Banks Maxwell Propeller Co., Hanger No. 4, Love Field, Dallas, Texas.

POPULAR AVIATION. Subscribe now to the magazine that leads the field in aviation. Leading articles, latest news in flying. Complete coverage. $2.50 (12 months).

WILL PAY CASH for good used metal hangar for Cub. E. L. Miller, McGregor, Minn.

COMPLETE PLANS for building powerful 110V Arc Welder. Four welding heats. Burns 5/32" rods. Send $1. Marvelweld, Box 1156A, San Francisco, Cal.

FOR SALE: Airport registered in Washington. Fly here or write for full particulars. Mayne Field, West Baldwin, Maine.

WORK ONE HOUR DAILY: Make big profit at home. Enjoy life. Instructions, blanks, postage, 8 cents. Pipe Sterilizer, Dept. 22, P. O. Box 4221, Atlanta, Ga.

PARACHUTES, buy, sell, pack for $3. Air show acts. Thompson Bros. Balloon & Parachute Co., Aurora, Illinois. Established 1903.

MODELS

A GREAT VALUE, a great model. Beautiful DeLuxe 15½" model of Spirit of St. Louis. Contains 100 pieces. Assembled and finished, $2.00. Send orders at once. Midwest Model Airplane Co., Ellis, Kansas.

FOR SALE: Curtiss "Robin" gas model. Good condition. George Robinson, Route 4, Box 34, Albany, Georgia.

MODELS—Catalog of 1¼" scale models, including drawings, 10 cents; Refunded on first order. Superior Model Company, Box 1994, Tulsa, Oklahoma.

PHOTOS

WANTED: Photographs of Canadian Gregor fighter, R.C.A.F. planes. W. T. Larkins, 5804 Ocean View, Oakland, California.

WORLD'S FAIR Candid Camera. Still and action shots. Reduced, $2.25, postpaid. 16 pictures, 25c. National Ads. 207 E. 84th Street, New York, N. Y.

PATENTS

PATENTS. Low rates. Information free. Samuel Goldstein, 275 E. Gunhill Rd., New York City.

PATENTS: Low cost. Book and advice free. L. F. Randolph, Dept. 372, Washington, D. C.

SITUATIONS WANTED

WANTED: Job as apprentice mechanic. Experience. Name terms. Write, V. Bolstad, Norwich, N. D.

WANTED: A millionaire to finance my aviation training. Box 141, La Fleche, Saskatchewan.

PRIVATE PILOT: Wants work at airport. Anywhere, vicinity Boston-New York. Accept flying time part salary. Wally Kach, 330 E. 35th St., New York, N. Y.

WANTED: Airplane welding work from private constructors, from your designs. Clayton Kennedy, P. O. Box 721, Gadsden, Ala.

LICENSED Airplane and Engine mechanic desires position at airport or repair station. M. Mostovyk, 707 Fairmount Ave., Philadelphia, Pennsylvania.

17,844 PILOTS READ POPULAR AVIATION EVERY MONTH

RADIO ENGINEERING, broadcasting, aviation and police radio, servicing, marine and Morse telegraphy taught thoroughly. 48 weeks' engineering course equivalent to three years' college radio work. School established 1874. All expenses low. Catalog free.
DODGE'S INSTITUTE, Dodd St., Valparaiso, Ind.

The Thunderbird

(*Continued from page 64*)

had done during the bloody days of the Great War; he simply "carried on."

Swinging clear of Wilderness Lake, Home-Hay opened his gun full out. He must get to Flin Flon and find help before disaster overtook him and his ship. Violent bumps and crashes from the cabin told him his insane passenger was trying to get into the cockpit.

As the ship rocked and lurched, Home-Hay clutched a fire extinguisher in his hand and flew his heavy plane with the other. Suddenly another vicious swerve almost tore the controls from his hand.

There was a battering sound from the cabin and Jeff turned his head just in time to see Mirasty smash against the frail cabin door. The door swung open slightly but the terrific wind pressure closed it once more. Again the Indian hurled himself against it.

Helpless to do anything, Capt. Jeff shouted and cut his gun. As the roar of the big motor lessened to a drone the shriek of the wind filled the air and with a final effort, Mois Mirasty, with a blood-curdling yell, smashed the door open and plunged to his death on the jagged rocks a thousand feet down.

Horrified, Home-Hay saw the Indian's body twist and turn in its mad downward flight. He watched until it disappeared in the tall spruce fringing the lake. In all his experience he had never heard or seen anything like this. Wetting his lips he opened the gun full out and tore for Schist Lake where he landed a short time later.

Search was immediately instituted for the body of Mirasty, but owing to the heavily wooded nature of the country it has not yet been found. Royal Canadian Mounted Police, with Indian trackers are scouring the bush while high overhead, bearing winter supplies to the outlands, and furs to the cities, "thunderbirds" piloted by men of iron nerves, roar back and forth as their pilots sit tight in the "front office" wondering when they too will have a "bushed" passenger to bring out. That they will have them, there is no doubt, for when tragedy stalks the white stretches of the great Lone Land inhabitants and animals alike look to the "thunderbirds" for aid, and it is not in vain.

END

Pipeline Plane

OFFICIALS of an Oklahoma pipe line company have expressed great pleasure at the results of a 2,000 mile inspection flight over the company's Texas and Oklahoma pipe lines.

The extensive flights were made with James K. Stepp, Spartan School of Aeronautics instructor, at the controls of the Taylorcraft while the superintendent in charge of the pipe lines checked the regular inspection of his line walkers. Many additional leaks and defects in the lines were found from the air.

PORT COLUMBUS FLYING SCHOOL INC
PCFS
Port Columbus, Columbus, Ohio
☆ THOROUGH TRAINING
☆ LATE TYPE EQUIPMENT
☆ AT REASONABLE RATES
☐ FLYING ☐ MECHANICS
Name..... Age.....
Street.....
Town..... State.....
Dept. P.A.

NOW! Brand New Fifth Edition AUTOMOBILE RACING BOOK
tells you how to lay out and build engines, frames, and bodies for fine dirt track cars. Rebuild instructions and horsepower curves for Ford A, B, and V-8. Data on superchargers, Indianapolis Grand Prix, International Formula, midget racing rules, world's record cars and speeds. Includes set dirt track car plans worth five times cost of book.
Order Fifth Edition AUTOMOBILE RACING NOW! $1.00 Postpaid; $1.15 C. O. D.
RAY F. KUNS, Dept. E-6
Madisonville, Cincinnati, Ohio

BUYERS' DIRECTORY

BOOKS

FLY $1
JUST OUT—A practical Course of Instruction by Bob Swift and Al Knouff, nationally famous instructors. Gives easiest method for everything from takeoffs to stunts and navigation. Illustrated. 20 chapters, 52 pages, only $1. Complete. Details on request.
The Aircraft Directory, Athens, Ohio

AERO BLUE BOOK
The 1939 Bluebook of Aviation gives specifications of 450 Commercial, Private, Military planes, 200 Aero Engines; Illustrations; Appraised value of numerous used planes; Points on buying used planes and choosing your Flying School; Lists of manufacturers, etc. Send $1 currency or money order.
AIRCRAFT DISTRIBUTING CO. $1.00 postpaid
Div. 7-PA 1480 Arcade Bldg. St. Louis, Mo.

STUNT
Exact method for every Stunt from simple wing-overs to outside loops. By Lieut. Joe Mackey, America's finest stunt pilot. Fully illustrated, complete. Price $1.00. Details sent on request.
THE AIRCRAFT DIRECTORY
Athens, Ohio

MISCELLANEOUS

Prepare Now For **YOUR LICENSE**
Airplane mechanic's home-study course $1.25. Engine mechanic's course $1.25. Both courses $2.00. Postpaid or C.O.D. Contains all license questions with answers and accurate diagrams. Helps you tremendously in your mechanic's as well as Pilot's License Exams.
"See you at the 1939 New York World's Fair"
MEYER ENGINEERING, Box-8-F Hempstead, N. Y.

FINISHED MODELS
Modern and wartime airplane models built to order. Fine construction; lacquered and rigged properly. Wingspans, 3" to 7". Smooth and glossy finish guaranteed. Name your model. Price—$1.75 each. Models having 12 inch wing spans will be built for $6.50 each; any model desired. No COD orders. No Stamps. Please print your name and address to avoid delay. Satisfaction guaranteed.
Actual "Goshawk" Model
MUELLER BROS. 28 Peach Street Buffalo, N. Y.

A COMPLETE ENGINE COURSE:

Aircraft Engine Mechanics Manual

by **C. J. Moors**, Chief Instructor, Department of Mechanics, Air Corps Technical School, U. S. Army. **511 pages. 189 illustrations. $4.50.**

Covers the same ground as the course given the enlisted mechanics of the Army Air Corps with the addition of much data on types of equipment adapted only for commercial airplanes. It deals thoroughly with all kinds of aircraft engines and their accessories.

Mr. Moors gives all needed data on construction and operation, supplies full instructions for proper maintenance, and shows you exactly how to go about making any necessary repairs and adjustments.

Particularly important is the detailed information on locating causes of engine troubles. The book is lavishly illustrated; photographs, diagrams, and working drawings make it easy for you to follow each explanation. 400 questions enable you to test your understanding of each subject treated.

Among the engines dealt with are: Pratt & Whitney, Wright, Curtiss, Lycoming, Warner-Scarab, Kinner, LeBlond, Continental. **Equipment covered includes:** Scintilla Magnetos, Eclipse and Leece-Neville Electric Generating Systems, Delco Battery-Generator Ignition System, Eclipse Engine Starters, Zenith and Stromberg Carburetors, Superchargers; Cooling and Lubricating Systems, etc., etc.

EXPLAINS WITHOUT MATHEMATICS:

Principles of Aerodynamics

by **Max M. Munk, Ph. D., Dr. Eng.**, formerly in charge of Aerodynamic Research for the N.A.C.A. **252 pages, 62 illustrations, $3.00.**

Written in simple language without any mathematical detail, this book is a reliable guide to a logical understanding of the principles of aerodynamics.

Dr. Munk is a world-renowned authority—no aircraft is designed without some direct or indirect use of theories and methods originated by him. His remarkable book makes crystal clear the basic ideas underlying many of the most complex design formulas. Its 7 parts include: General Aerodynamics. Wing Section Theory. Wing Theory. Experimental Aerodynamics. Propeller Theory. Applied Aerodynamics.

(fill in, tear out and mail)

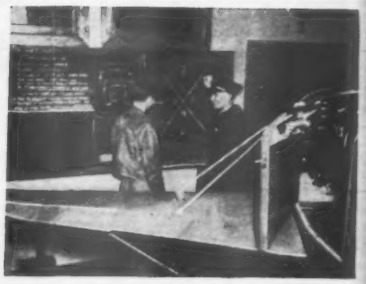
Sent on 5 Days' Approval

The Ronald Press Company
Dept. M329, 15 East 26th St., New York

Send me the books checked below with the privilege of examination before purchase. Within five days after books are received I will return any that are not satisfactory and remit for those I keep at the prices shown plus a few cents for delivery. (We pay delivery on orders accompanied by remittance; same approval privilege.)

- ☐ **Simmons, Air Piloting** $3.00
- ☐ **Eddy, Aeronautic Radio** 4.50
- ☐ **Moors, Engine Manual** 4.50
- ☐ **Munk, Principles of Aerodynamics** 3.00

Name .....
Home Address .....
City ..... State .....
☐ Employed by
☐ or Reference .....
(Must be filled in unless you remit with order)
Address .....
*Outside continental U.S. and Canada send cash plus 25c per book for shipping.
☐ **CHECK HERE if you wish our catalog of Aeronautic Publications, FREE.**



WILL HELP YOU PASS FLIGHT AND WRITTEN TESTS FOR ANY RATING

New Book—on Primary and Advanced Training

Air Piloting: Manual of Flight Instruction

by Virgil Simmons, *formerly Flying Instructor at Boeing School of Aeronautics and in U. S. Army and Navy Air Services*
300 Pages, 75 Illustrations, Price $3.00

BASED on the latest government regulations, this new book supplies in detail the flight training instructions needed by student pilots and also by pilots, already proficient, who aspire to attain higher grades. It will be helpful to flying instructors and to pilots who wish to obtain that rating. "Air Piloting" is designed for use as a text in primary and advanced courses given at flying schools. Pilots who wish to correct faults and attain greater proficiency in precision flying will find it a practical guide. Throughout it reflects the author's twenty years experience as a flying instructor.

All flight test maneuvers now required for the various pilot certificates and flying ratings are completely analyzed and explained. Complete diagrams illustrate every detail of each maneuver's execution and make them clear and easily understood. In addition to full instructions on primary essentials, the manual contains much information on advanced flying techniques, including exhibition aerobatics. Its descriptions of average faults and explanations of their causes will help *any* pilot to increase his skill.

Particularly important are lists of specimen questions—totaling 377—taken from ocial written examinations for all grades of pilot certificates, including that of flying instructor. Answers that have been accepted as correct accompany each.

PARTIAL OUTLINE: Piloting an Airplane. Primary flight training maneuvers: Straight and level flying. Climb and glide. Gentle turns. Turns in glide. Climbing turns. The take-off. Taxying. Landing. Medium banks. Steep banks. Stalls. Spins. Base-line glide approach.

Civil Air Regulations. Selected air traffic rules which must be thoroughly mastered by student pilots preparing for examinations.

Solo Pilot Flight Course. Procedure before and after solo. Factors to observe in primary S's 1 and 2. Advantages of the base-line glide approach. Summary of flight test requirements.

Private Pilot Flight Course. Shallow, circular, steep eights. Triangulation spirals. The 180°, 360°, 1080° spirals; vital factors to keep in mind. Practicing stalls, with and without power. Primary and advanced spins. Procedure for the 720° vertical bank. Cross-wind take-offs and landings. Forward and sideslips; slipping turn.

Limited-Commercial Pilot Course. Restrictions and privileges of the limited-commercial pilot rating.

Commercial Pilot Flight Course. Summary of maneuvers in flight test. Precision maneuvers recommended for developing skill in handling plane near ground, from predetermined exact altitudes. Night flying. How to execute the split-S turn; the chandelle; skyline 8; half roll; barrel roll; loops; falling leaf.

Cross-Country Flying. Map reading. How to lay out a cross-country course. A typical cross-country flight with detailed explanation of pilot's procedure.

Airways Radio. Radio-range orientation described and illustrated—90° method, parallel bisector method. Radio compass navigation; fundamental principles explained. How to obtain bearings. Establishing fixes.

Instrument Flying and Rating. Maneuvers that must be performed, solely by instrument, in practical blind flight test. "How radio skill must be demonstrated. Airplane, Link Trainer instruction methods. Flight Plan. Typical practice flight procedure.

Flying Instructor Rating. Latitude given examining inspector, to assure himself of candidate's qualifications. Summary of flying school rules and sequence of training maneuvers for primary and advanced students with which prospective instructor is expected to be familiar.

Jess Green *says:* "Congratulations on 'Air Piloting.' I have examined it intensively and have nothing but the highest praise for it. I believe it is a very comprehensive manual containing a great quantity of valuable material. The outstanding feature in my opinion is the up-to-the-minute point of view throughout the book, incorporated in subjects, material, and methods used."

Jess Green
Director, Spartan School of Aeronautics, Tulsa

THE RONALD PRESS COMPANY, Publishers
15 East 26th Street ESTABLISHED 1900 New York, N. Y.

PREPARES FOR OPERATOR'S EXAMINATION

Aeronautic Radio

by **Myron F. Eddy**, Lieut., U. S. Navy, Retired; Member, Institute of Radio Engineers; Chief Instructor in Aircraft Radio, Stewart Technical School. **502 pages, 198 illustrations, $4.50.**

This new book provides a complete, up-to-the-minute guide to principles, selection, installation, operation, and maintenance. In preparing it, Mr. Eddy has kept in mind two considerations: First, the requirements of the Federal Communications Commission as to the aviation radio operator's licenses and the regulations of the Civil Aeronautics Authority as to radio in aeronautics, especially its use by commercial and private pilots. Second, the actual approved usage of existing equipment for both communication and for special purposes such as course guidance and instrument landing.

The first eleven chapters, if carefully studied, should prepare you to pass without difficulty the theoretical part of the examination for an aviation radio operator's license. The next five chapters explain special applications of radio to aeronautics; they include many important new developments. 205 questions enable you to test your grasp of the information given in these chapters.

16 CHAPTERS: Aviation Radio Communications. Fundamentals of Electricity. Radio Electricity. Radio Circuits. Radio Tubes. Batteries. Power Supplies. Radiotelegraph Transmitters. Radio Range Beacons. Radiotelephone Transmitters. Receivers. Direction Finders. Instrument Landing Systems. Radio Traffic Control. Installation of Equipment. Maintenance.